SCIENTIFIC AMERICAN

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A CHARACTERISTIC GROUP AT THE BROOKLYN NAVY YARD.

It is not often that the photographer is able to include within the field of his camera such a notable and representative group of our ships as is shown in the front page engraving of this issue. The view was taken at the Brooklyn Navy Yard at the time when the North Atlantic squadron was completing its last refit before setting out for southern waters. All the ships had just received their new coat of white paint, and it must be confessed that their peace-time color is infinitely more picturesque than the dull, leaden gray under which they are carrying out the grim duties of war.

It so happens that this group of ships contains representatives of the principal types of our warships—if we except the monitors and torpedo boats—and the vessels all belong to what might be called the second era of construction in our new navy, embodying as they do the experience which had been gathered from the behavior of the earlier vessels. Perhaps the most striking feature common to all these ships, and especially noticeable in the "New York" and the "Brooklyn," is their generous freeboard, the guns being carried well up above the waterline. It is realized pretty generally throughout the navies of the world that seaworthiness is a prime requisite in a warship, and if anyone will compare the present ships with those built fifteen or twenty years ago, he will notice that the guns, especially in the battleships, are now carried from one to two decks higher than they were. The forward 12-inch guns of the "Iowa," for instance, are 8 or 10 feet higher than those of the "Indiana," which was built a few years earlier, and they fire over a spar deck which extends aft for two-thirds of the ship's length. The same improvement is noticeable in the "New York" as compared with the "Atlanta" or the "Boston." Here the upper or main deck is flush throughout the length of the ship, the whole of the main battery of six 8-inch guns discharging over this-deck. In the "Brooklyn" the tendency to lofty freeboard is carried still further, and a forecastle deck is added above the main deck, the forward pair of 8-inch guns firing above this deck at an elevation above the sea of not less than 32 feet.

Now the highest recorded waves in an Atlantic storm do not run much above 25 to 27 feet, and consequently the line of fire of the forward guns of the "Brooklyn" would be well above the tops of the waves in practically any weather. It can be readily seen that if a duel took place in a heavy sea between the "Indiana," whose 13-inch guns are only from 16 to 18 feet above the water, and the "Brooklyn," six guns of whose main battery are 26 feet and two of them 32 feet above the water, the high freeboard ship would have an advantage that would go far to offset her lighter armament. While it is true that there are more calm days than rough at sea, the advantage of having ships that are ready for anything that comes in the

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COMMODORE GEORGE DEWEY, THE HERO OF MANILA BAY.

"New York." "Cincinnati." "Brooklyn." "Newport." "Iowa."

A CHARACTERISTIC GROUP AT THE BROOKLYN NAVY YARD.

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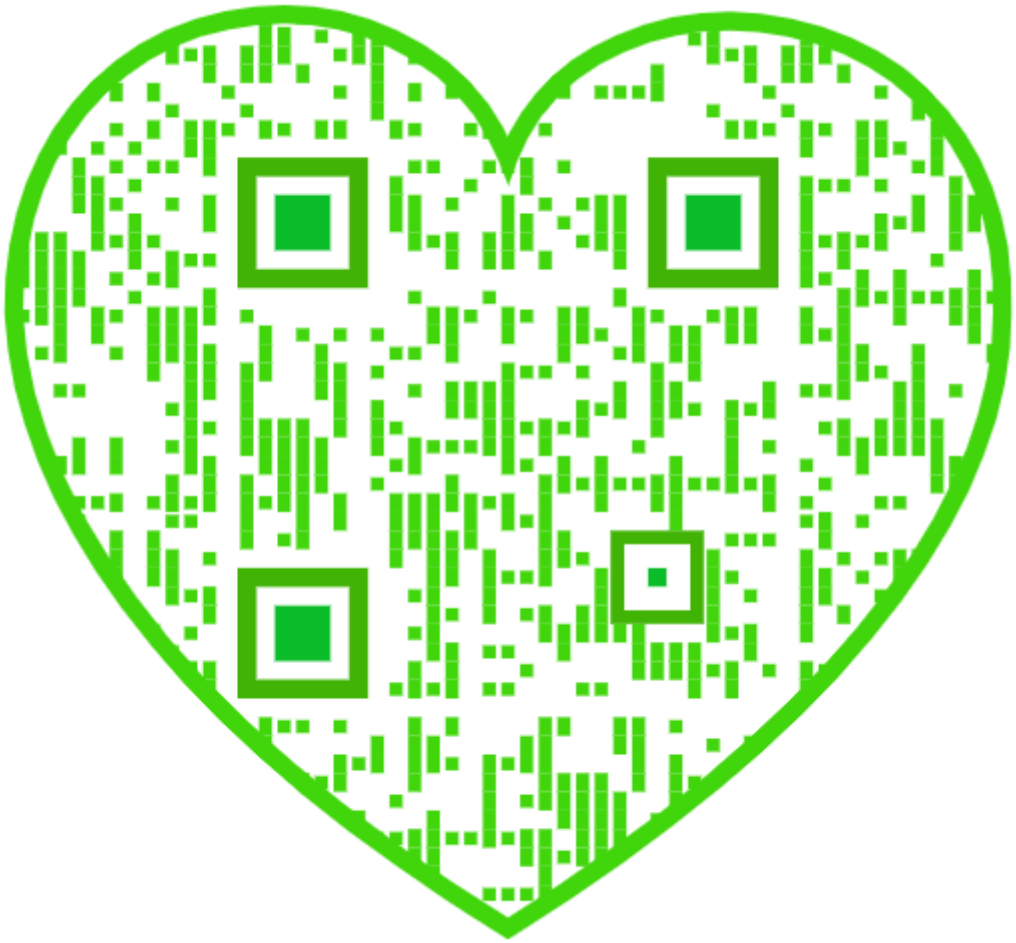

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THE NEED FOR MORE ARMORED CRUISERS IN OUR NAVY.

We feel constrained to urge again the necessity for the addition of more armored cruisers to our navy. The naval appropriation bill this year is, we believe, not yet past the stage where it is possible for changes to be made, and we are firmly convinced that the interests of the country will be served by the reconsideration of this very important question. We think that the bill, as finally signed by the President, ought certainly to include provision for at least two or three of this invaluable type of ship. Even if they were to be included at the cost of some of the coast defense monitors already provided for in the bill, we are strongly of the opinion that the new programme of construction would gain in strength. If it is considered that the monitors are imperatively needed, the appropriation, large though it already is, should be increased to the extent necessary for the construction of more of these serviceable ships.

The fact that Spain has a fleet of 20-knot, heavily armed and armored cruisers at sea, threatening to strike at one of half a dozen important points, and capable, after striking a blow, of escaping by virtue of its superior speed from our powerful battleships and monitors, emphasizes the value of this type of vessel both for offense and defense. For it is evident that the proper safeguard against a fleet of armored cruisers is a fleet of the same kind, having the same combinations of high speed, powerful guns and good protection. At present we have only the "Brooklyn" and the "New York." If we had but twice this number, we could dispatch the quartet against the Cape Verde fleet, with the certainty that they could catch and destroy it. But, as matters stand, we have no two armored ships with sufficient speed to enable them to cruise in company with the "Brooklyn" and "New York" and join with them in a full speed pursuit of the enemy.

Beyond all doubt the most pressing need of the navy is the addition of more "Brooklyns" and "New Yorks" to its fighting line. In the United States navy there are now built, building or authorized thirteen battleships and ten monitors, making a total of twenty-three heavily armored vessels. If any general criticism can be made of this, our first line of defense, it is that it lacks in mobility—that while it is admirable for defense, it is not capable of those swift movements which at a critical time may turn the fortunes of a campaign. The addition of two or three 20-knot armored ships, however, would remove this defect and render us capable of making a swift concentration of powerful ships at any desired point, either for attack or defense. Such a fleet distributed among our seacoast cities and capable of quick assembling would effectually dispose of the bugbear of bombardment by the enemy.

It should be borne in mind that unless provision is made in the present bill for additional armored cruisers, it will probably be four years before we shall have any more of this class afloat. One year, at least, will intervene before the matter can again come up for consideration, and it would probably take three years after authorization before they could be put in commission.

We cannot but feel that should the changes suggested above not be made, our navy of the year 1901 will be very ill balanced in its composition.

THE CAPE VERDE FLEET AND THE "OREGON."

What is the probable destination of the fleet of armored cruisers and torpedo boat destroyers which recently set sail from the Cape Verde Islands? Has it gone north to effect a junction with the second division of Spanish ships now about to sail from the mainland? Is it on its way to cruise along our northern coasts and inflict what damage it can upon our less strongly fortified cities? Will it attempt to make Porto Rico and shelter itself inside the harbor mines and beneath the guns of the fortifications and await there the arrival of the second squadron; or, is it now off the coast of Brazil, strung out in scouting order across the track of the "Oregon," waiting to close in, on sighting her, and crush the ship by the sheer force of numbers?

There has been much fear expressed that the last is the move which has been undertaken, and that, before any reinforcements can reach her, the "Oregon," with her little consort the "Marietta" and the unprotected "Buffalo" ("Nictheroy"), will find herself confronted by an overwhelmingly superior force. It seems to us, however, that, in spite of the tempting opportunity presented to get rid of one of our four first-class battleships, the cost of victory will appear too great to warrant the attempt. Leaving out of consideration the unarmored and unprotected "Marietta" and "Buffalo," which would only invite destruction by coming within range of the 11-inch guns of the Spanish cruisers, we think that the tremendous offensive and defensive powers of the "Oregon" should enable her to sink one or two of the enemy and seriously cripple the others before she was sent to the bottom, for it goes without saying that no American flag will ever be struck in the present war.

The Spanish fleet consists of four cruisers: the "Cristobal Colon," "Oquendo," "Maria Teresa" and "Vizcaya." The first ship is, we think, the best of the four, and, taken all round, is perhaps the most formidable, though by no means the largest, in the Spanish navy. She is an Italian built ship of 6,840 tons and 20 knots speed, and carries a complete belt from stem to stern of 6-inch Harveyized steel, while above this is a continuous armored redoubt of 6-inch Harveyized steel which protects a battery of ten 6-inch rapid-fire guns. Above this again is another battery of six 4·7-inch rapid-fire guns protected with 2-inch plates and revolving shields. The heaviest armament consists of two 10-inch armor-piercing guns in 6-inch barbettes. There is a secondary battery of ten 6-pounders and ten 1-pounders. The three others are sister ships. Two of them are familiar to residents of New York, the "Maria Teresa" having lain in the North River during the Grant dedication and the "Vizcaya" visiting this port shortly after the "Maine" was destroyed. Each ship is of 7,000 tons displacement and twenty knots speed, with a 3-inch deck, 12-inch waterline belt and 10½ inches of steel protecting the heavy guns. Each is armed with two 11-inch guns, ten 5½-inch quick-fire guns, and fourteen 6-pounders and 1-pounders. The three destroyers are of about 400 tons displacement and 30 knots speed.

Now, what has the "Oregon" to oppose to the four cruisers (we will suppose that the "Buffalo" and the "Marietta" can take care of the destroyers) in a battle upon the high seas? To the two 10-inch and six 11-inch armor-piercing guns, whose total energy is 132,000 foot-tons, she could reply with four 13-inch armor-piercing guns, with a total energy of 134,500 foot-tons. In addition to this, if the attacking ships ranged on one side of the "Oregon," she could reply with four 8-inch guns of 32,000 foot-tons energy, and if on two sides, she could reply with eight 8-inch guns of 64,000 foot-tons combined energy. In ability to pierce the vitals of the enemy, it will be seen our ship has an advantage of 34,500 foot-tons over the combined Spanish fleet. In respect of protection, the "Oregon" is even stronger than she is in heavy gun fire. To reach her 13-inch guns, the 11-inch shells of the enemy must penetrate at least 15 inches of face-hardened Harveyized steel. To get into the engine or boiler rooms they must pass through 18 inches of the same protection. Now, the Spanish 11-inch gun is barely able to penetrate 15 inches of common steel at 2,000 yards (the probable fighting range), and it can do this only if it strikes at right angles to the surface of the target and if the steel plate is of the ordinary quality. The "Oregon's" steel armor, however, is face-hardened, and would easily break up or resist complete perforation by such few shells as might strike normal to the surface. We are now speaking of the vitals and the main gun positions, and, turning to the Spanish cruisers, we find that they have only 10½ and 12 inches of an inferior grade of armor (i. e., inferior to our Harveyized steel) to oppose to our 13-inch guns, which are capable of penetrating 20 inches of steel at 2,000 yards. Now, these guns, because of their excellent protection, could fight for hours with little likelihood of being disabled, and the question arises what would become of the Spanish barbettes and waterline belts in the meantime? Under the excellent marksmanship which characterizes our gunners, it is safe to say that in a stand-up fight of any duration the "Oregon" would disable every heavy gun of the enemy and place her 13-inch shells in the vitals of every cruiser.

There are other elements of strength and weakness, however, which must be considered. In the matter of heavy rapid-fire guns, the advantage would be the other way, the cruisers being able to open fire from one broadside with five 6-inch, fifteen 5½-inch and three 4·7-inch rapid-firers. To this we could oppose from one broadside two 6-inch slow-firers. Taking the average assumed speed of fire per minute for each type of gun, the energy of the metal thrown by the cruisers in one minute would be about 500,000 foot-tons against 10,000 foot-tons for the slow-firers of the "Oregon." The effect of this awful hail of bursting shells would depend upon the accuracy of the Spanish gunners and the part or parts of the "Oregon" against which it was directed. It would be harmless against the 17-inch barbettes, the 15-inch turrets or the 18-inch belt. If it were directed against the thin plating beneath the 8-inch gun barbettes the guns would, of course, be put out of action. The real danger would be that it would be aimed at the unarmored ends of the vessel beyond the armor belt, which would be blown away and admit water above the protective deck, throwing the ship off an even keel and interfering with the working of the main guns.

The greatest danger, however, to the "Oregon" would be from the ram, and it is probable that the swift cruisers would close in from opposite sides in the effort to deliver the fatal blow before they had themselves received a mortal blow from her powerful guns. It is certain she could be sunk by these tactics, but it is more than probable that she would cripple all of her antagonists and eventually take one or more of them with her to the bottom.

Unless the Spanish naval authorities are criminally

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ignorant of the fighting powers of our individual ships, they already foresee that the sinking of the "Oregon" would be a worse than fruitless victory, and would cripple their first line of battle beyond all future hope of meeting our fleet successfully in a general engagement. There would be nothing left for the crippled ships but to get home to the dry dock as best they could, and it would be months before Spain would be ready for active operations.

All the probabilities point to a combination of the late Cape Verde squadron with the home squadron which is gathering at Cadiz. This will probably include the battleship "Pelayo," 9,000 tons; the armored cruisers "Carlos V.," 9,235 tons; the "Cisneros," "Cataluna" and "Asturias," 7,000 tons, three sister ships to the "Vizcaya;" the protected cruisers "Alphonso XIII." and "Lepanto," 5,000 tons; and the two reconstructed iron battleships "Numancia" and "Vitoria," of 7,300 tons, which have been re-engined and armed with modern rapid-fire batteries. Not all of these ships are immediately available; but from a careful comparison of foreign references to their condition, it looks as though they would be ready for sea in two or three weeks. In view of the great strength of our fleet, it is not likely that Spain will send out her ships to be beaten in detail. A careful review of the situation leads us to believe that, if we do not take the initiative, Spain will send a modern armada of some thirteen warships across the Atlantic within the next thirty or forty days.

It would be a formidable fleet of thirteen ships; but with the memory of Dewey and Manila fresh in our minds, we have no misgiving as to the result.

TO OUR SCIENTIFIC AMERICAN SUPPLEMENT SUBSCRIBERS.

We feel that an apology is due to those subscribers of the SCIENTIFIC AMERICAN SUPPLEMENT whose copies of the Special Navy Edition may have put in a belated appearance. When we arranged to bring out the Navy Special as the regular edition of the SUPPLEMENT, we did not anticipate that the edition would create the extraordinary demand which has arisen. In spite of the fact, however, that we had made what we considered ample provision for an increased sale, the demand at once ran far beyond our expectations; and this fact, coupled with the unusual size of the edition, the preparation of the map, and the desire on the part of the editors to collect the very latest and most exact information regarding the navy, is answerable for a delay which, much to our regret, our best efforts have been unable to prevent.

Our readers may be interested to know that, judging from the inquiries which come into this office, public interest in the navy is not limited to any one section of the country. For some years many have thought that outside of the Eastern States there was little concern in the building up of our new navy. It appears, however, from the communications which we have received from the Pacific coast, the States of the middle West and from the South, that the whole country is earnestly desirous of getting reliable information concerning our first line of defense.

THE NEW YORK ELECTRICAL EXHIBITION.

The exhibition opened on Monday evening, May 2, at the Madison Square Garden, and was crowded with interested visitors and guests, who listened to the opening address by the Hon. Chauncey M. Depew with eager attention. Mr. Depew spoke of the marvelous development in the industrial applications of electricity, introducing many humorous and patriotic epigrams, and, finally, concluded by stating that he would fire a Spanish gun by a wireless telegraph system, which is one of the latest developments in electrical science. The experiment was successfully done, and out of a Sims pneumatic dynamite gun were shot portions of American and Cuban flags. He then illustrated how the "Maine" was blown up by exploding a miniature bomb in the fountain in the center of the hall, by a direct circuit, which threw up in the air a miniature model of the vessel. But, since the opening night, the bomb is exploded regularly, four or five times a day, indirectly through the wireless telegraph system, and is rather puzzling to those who do not understand it. We have had an opportunity ourselves to make the explosion, which is very effectual and certain. Briefly, the electrical waves passing through the air cause the coherer located near the fountain to close its relay, which puts into operation a local battery circuit, and heats the bomb fuse to redness, when the bomb immediately explodes.

President McKinley, from the White House, at Washington, sent a congratulatory telegram which was read by Mr. Depew, and at 8:47 p. m. the President pressed the key at Washington which opened the exhibition. Vice President Hobart sent a message by telephone which was recorded on a phonograph cylinder as delivered and then repeated during the evening by the phonograph.

On the main floor of the hall may be seen numerous forms of heavy electrical apparatus, such as large dynamos for electrical railways, pumping outfits, electrical heating apparatus and the practical application of electricity for uses of the household, including automatic electric elevators, electrical cooking utensils, hair curling irons, soldering irons, laundry irons, etc. There is also a novel display of the use of electricity for transportation purposes, such as four different kinds of electric vehicles operated by the storage battery system, on one of which was the placard that it had traveled 3,000 miles.

The bodies of most of the vehicles were capacious and of the piano-box plan for the purpose of providing storage room under and beyond the seats for the driving battery, but otherwise their appearance resembled that of an elegant victoria, surrey, trap, cab or a covered dry goods delivery wagon. One noted departure from these expensive styles is a carriage which has three wheels, the single front driving wheel being about three feet six inches in diameter and carrying a frame on each side for the support of the storage batteries as well as the motor. The pinion of this motor gears into a cog rack near the periphery of the wheel, at which point the power is applied. The promoters claim that thereby there is not so much leverage to overcome as when the power is applied to the axle. The controller and steering handles are hinged to turn one side when the occupant enters or departs from the carriage. The front wheel supporting the batteries presents a very queer appearance and would, we think, be likely to frighten horses. But, on the score of economy, it is an interesting application of electricity and may become popular.

Near this display of electric carriages is a full sized Stephenson electric street car, running on a track raised three feet from the floor and about fifty feet long, showing the complete construction and working of the underground trolley system as now adopted by the New York Metropolitan Street Railway. It is most effective in showing the practical possibilities of this system.

At the east end of the hall is a beautiful model twenty-five foot electric launch, which has the storage batteries and motor under the floor, and is furnished with six very comfortable chairs and a table. It might be termed a new form of house boat, so handsomely and conveniently is it equipped. Nothing but the steering wheel in the bow indicates that there is any machinery about it.

There is a large exhibit of mammoth storage batteries, now so generally used in electric lighting plants.

In the north basement are three types of gas-engine-driven dynamos, for lighting purposes, which demonstrate their economy over steam and adaptability for local lighting plants. These we shall allude to at some future time.

In one of the upper rooms of the building is arranged a very novel exhibit of the application of Mr. D. McFarland Moore's novel plan of lighting by means of vacuum tubes. He has arranged a room about 20 feet long by 10 feet wide to represent the interior of a small chapel, having an altar and organ at one end and pews on each side of a center aisle. There are eight Gothic arches, each one having electric luminous vacuum tubes formed to fit the curve of the arch, while one long tube made in two parts extends the length of the chapel under the ridge of the supposed roof. The lighting gives one the impression of twilight; it is bright enough to read print by, yet very soft, pleasant and agreeable. This, no doubt, is one of the attractions of the exhibition. In an adjoining room to the chapel is a working model of the third-rail system as applied to steam railroads.

The practical working of wireless telegraphy as at present perfected is one of the curiosities and novelties of the exhibition. In a glass case on one side of the hall is placed a storage battery and the transmitting instrument automatically operated by an electric motor and a switch wheel arranged to make the Morse alphabet signal of N and Y. The induced current from the induction coil is, at these intervals, discharged between the ball terminals, and coincident with the discharges one hears the ringing of an electric gong on the opposite side of the hall, about three hundred feet distant. Wires connect each instrument to the earth, but there is no connection through the air. We were informed that preparations are being made to send signals from the tower of the building to a receiver located in Jersey City, about five miles distant, and shall hope to be able to record the success of the experiment.

The New York Telephone Company has a model set of cabinets and exchange installations, while at one side is what is called the "theaterphone," a series of telephones connected to different theaters, by which one can hear the performance by telephone, a transmitter, of course, being located on the stage.

The exhibition will remain open afternoon and evening till May 31. It should attract many visitors, as there are many interesting and instructive exhibits.

Record from Honolulu Broken.

The steamer "Mariposa" arrived at San Francisco May 3 from Australia and Honolulu. She broke the record from Honolulu, making the trip in five days and twenty-three hours.

THE AMERICAN ISLANDS.

Mr. Alexander D. Anderson has an article in The Review of Reviews, in which he gives exact data respecting the ownership of the islands off our Atlantic coast.

	No. of Islands.	Area Sq. Miles.
Spain	2	39,562
American republics	1	26,247
Great Britain	54	11,570
France	3	1,103
Netherlands	5	434
Denmark	3	223
United States	0	0
Total	68	81,140

The above comprises simply the islands large enough to be named in atlases or cyclopedias. Looking at this list, it is amusing to recall the position taken by foreigners that the United States have no right to desire a transfer of any of these islands to her control, no reason to look askance at this line of foreign and always hostile possessions, and no interests that make these islands necessary to us! The question is often asked, Why is there so much hostile feeling among Americans toward England? and the answer is plain enough. Great Britain is the only nation that is arming herself against this country. We consider her course in this respect foolish, and one that she will pay a heavy price for some day, whatever the cost may be to us. It is, however, consistent with her policy in other parts of the globe and one that has led to great disturbance. Some comprehension of the dangers of such a course seems to have come to Lord Salisbury, who said in defending his policy in China: "I believe there is danger in our public opinion of a reaction to the doctrine of thirty or forty years ago, when it was thought that it was our duty to fight everybody and take everything. I think that a very dangerous doctrine, not merely because we would thereby excite other nations against us—and the reputation we now enjoy in Europe is not by any means pleasant or advantageous—but because there is a much more serious danger of overtaxing our strength. However strong we may be, there is a point beyond which our strength does not go. It is courage and wisdom to exert that strength to its attainable limit, but madness and ruin to pass it." As we see the situation on this side of the Atlantic, these words are pertinent to the course of the English in fortifying her islands.

The subject of Mr. Anderson's article is the American republics, says The Army and Navy Journal, and he shows that in January, 1800, ours was the only republic in the new world and its area was only 5 per cent of the surface of the two Americas, or, as he calls them, the three Americas. Spain held 7,028,628 sq. m., or 45·7 per cent; Great Britain, 3,719,109, or 24·2 per cent; Portugal, 3,209,878, or 20·9 per cent; United States, 827,844, or 5·4 per cent; Russia, 577,390, or 3·8 per cent; France, 29,352, or 0·01 per cent; Netherlands, 433, or 0·0 per cent; Denmark, 223, or 0·0 per cent. Total, three Americas, 15,392,858 sq. m. Spain's folly has lost to her nearly 7,000,000 sq. m. of her colonies, every mile of which has been republicanized, and now the distribution is: American republics, 11,632,426 sq. m., or 75·6 per cent; Great Britain, 3,626,352, or 23·6 per cent; France, 47,800, or 3 per cent; Netherlands, 46,494, or 3 per cent; Spain, 39,563, or 2 per cent; Denmark, 233, or 0·0 per cent. Total, 15,392,858. Our own growth has been from 827,844 to 3,602,990 sq. m., or from 5·4 to 23·4 per cent of the whole.

NEW TRANSATLANTIC RECORDS.

The magnificent fleet of liners that carry on the transatlantic traffic are steadily reducing the time which it takes to pass from the old to the new world. The great feat of the North German Lloyd steamship "Kaiser Wilhelm der Grosse," of last autumn, when she crossed at an average speed of 22·35 knots, still stands unchallenged; but some remarkably fast all day runs have since been made, one by this same ship and the other by the "Lucania," of the Cunard line. The latter vessel was queen of the seas previous to the arrival of the "Kaiser Wilhelm," having an average hourly record for the whole trip of 22·01 knots. This was eclipsed by the North German Lloyd ship when she maintained an average for the eastward trip to Southampton of 22·35 knots. About a month ago the "Lucania" eclipsed all previous records by maintaining 22·92 knots on an all-day's run, and this has now been surpassed by the German ship, which on its last westward trip maintained an average speed of over 23 knots for one whole day.

THE St. Petersburg correspondent of The Times writes, stating that he has had an opportunity of inspecting the first through train de luxe to be dispatched direct to Tomsk over the Siberian line, which in a few years more will run right on to Port Arthur. It is, he states, composed of four splendid cars built at Moscow and fitted with all the latest improvements and conveniences, including an open saloon, a dining car, a bath room, a library, telephones, electric lighting, refrigerators and ventilating apparatus, a piano, and means of gymnastic exercise.

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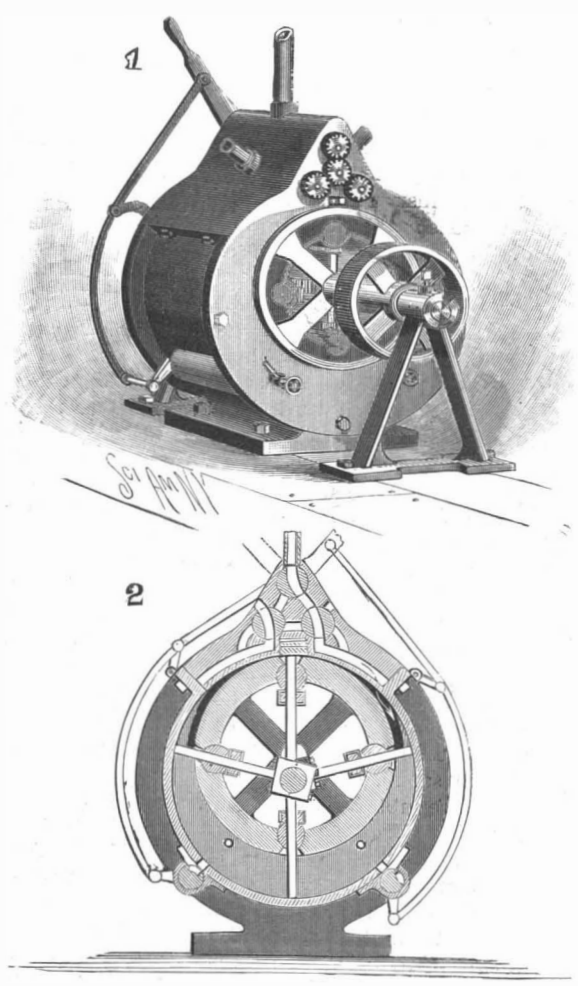
AN IMPROVED ROTARY ENGINE.

An easily reversible, simple and compact rotary engine is that which has recently been patented by Reuben P. Jarvis, of Smith Center, Kansas. Mr. Jarvis' engine, of which we present perspective and sectional views, consists of a cylinder in which a piston is eccentrically mounted, the peripheral surface of which is in contact with the cylinder at a packing held in a recess of the cylinder and adjusted toward the periphery of the piston by two wedges which slide upon each other and are controlled by two set screws. The piston is provided with a number of piston heads, as shown in the lower illustration, all pivotally connected at their inner ends with a crank arm secured on the shaft. The piston heads extend through slots in the rim of the piston and are fitted to slide in trunnions mounted to rock in bearings attached to the piston. On each trunnion is secured a packing for making a steam-tight contact joint between the abutment and its trunnion. The packing is provided with a casing fastened to the trunnions and containing packing plates fitted upon the side faces of the piston head, and engaged at their outer surfaces by bars pressed up against the packing by set screws working in the casing. By this arrangement the engineer is enabled to screw the packing plates into firm contact with the piston heads, thus preventing the leakage of steam past the abutment into the open piston.

On opposite sides in the heads of the cylinder two sets of ports are most ingeniously arranged. The valve



JARVIS' IMPROVED ROTARY ENGINE.

shaft of each set of ports and that of the main steam inlet port are provided at their extremities with gear wheels which mesh with a central gear wheel mounted on the outside of the cylinder, as shown in the upper engraving. To the main steam inlet valve a handle is secured which, upon being turned, causes the gear wheels to act simultaneously upon their valves, and enables the engineer to place either set of ports in connection with the main steam inlet port. An easy method of reversing the engine is thus provided; for, by merely turning the handle from left to right or from right to left, as the occasion may require, the engineer can disconnect the acting set of ports from the main steam inlet port and place the latter in register with the other set of ports, causing the piston to revolve in the opposite direction.

The engine is either simple or compound, using as many low pressure cylinders as the steam pressure justifies. At the instant the steam begins doing expansive work in a low pressure cylinder it has the advantage of the greatest mechanical leverage and the greatest piston head area to work against, while its pressure is at its highest point in the particular low pressure cylinder in which it is doing work. The engine is easily reversible and runs equally well in either direction. It is simple, compact, of durable construction and easy of access; all parts of it being adjustable from the exterior. All lost motion in the bearings and steam packing is taken up automatically, if need be, by means of caps upon cones, and wedges upon plain surfaces. These adjustments it is claimed keep the engine absolutely steam-tight and also serve to distribute all strains and wear equally throughout the engine. They also keep the engine in line. Another feature of these adjustments is the fact that nearly all the wear is taken up by them, so that when worn out they may be replaced by new ones, thereby making the engine very lasting. The inlet and exhaust ports can be made very large without materially affecting the efficiency of the engine, making one of the simple type a very high speed engine. An engine of the compound type can be geared to the transmitting journal, bevel or pulley for either speed or power. The engine is easily lubricated by any modern method, has direct connecting facilities and has no working valves. Having a continual flow of steam it is easily governed and could be made to do automatic expansive work. It can be provided with auxiliary ports and valves whereby any or all the low pressure engines can be made to do high pressure work at any time. Owing to the construction of the engine, the steam can be easily and comparatively inexpensively superheated while exhausting from a higher to a lower pressure cylinder, by specially devised means for that purpose.

Roman Fever.

The superstition that Rome is an unhealthy place to live in is discussed by Mr. W. J. Stillman, in "Old Rome and the New." Mr. Stillman has lived in Rome so many years that his judgment on this subject may be accepted as of great value. He states that the superstition as to the sanitary condition of Rome runs back into the dark ages, but is unjustified by any statistics. He says that in a residence of nearly a dozen years in the aggregate and extending over a period of thirty years, he has never had a single serious illness or a case of typhoid or malaria in his family, nor among his acquaintances has he ever known one-half dozen cases of intermittent or malarial fever and not one of any gravity. He has repeatedly stayed in Rome during the entire summer without any discomfort or inconvenience. He has never met with a case of so-called "pernicious" fever, and Dr. Drummond, who has practiced in Rome for years, says he never saw a case. The statistics of the Italian Sanitary Department are drawn up with the greatest care and exactitude, and the record of deaths from malarial fevers for the commune of Rome, including the Campagna and all of the malarial districts, only shows a total of 308 out of a population of 500,000, and this enumeration includes peasants who spend their lives in the marshy and fever-infected districts. Mr. Stillman says he has traveled in the worst parts of Maremme, which are regarded as most deadly and malarial in Italy, as late as the latter part of June, and he found the harvesters at works in gangs; and at Grosseto, the capital of Maremme, which the guide books tell us is abandoned by the inhabitants on the first of May, he found the entire population on the ramparts listening to the band until late in the evening.

Typhoid is common in great cities, but in Rome less so than in most of the cities of its size. The water supply of Rome is probably the best as to its purity and the most abundant in quantity of any furnished to great cities. Typhoid very rarely occurs among the inhabitants of the better class, except from drinking water at some wayside spring. The sanitary laws are inflexible, and the tenant of a neglected house has always the remedy in his own hands. Mr. Stillman says: "I have no hesitation in saying a person in moderate circumstances, able to choose his quarters, can pass the months between September and July in Rome under as favorable conditions of health and comfort as in any city in Europe; and with less precautions against the heat than in New York one must take against the cold, he may pass the entire year."

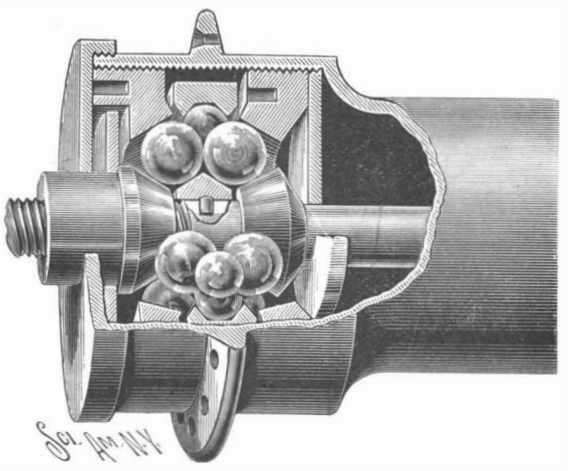
Fraudulent Mining Schemes.

Promoters of Alaska transportation and mining schemes, says The Mining and Scientific Press, seem to figure on even more than ordinary gullibility on the part of the general public. Some of the offers and inducements are more barefaced than those of 1897. As usual, some of the British schemes are worse swindles than those concocted in this country, which is saying a good deal. In London papers are now being published prospectuses beside which the recent ridiculous romance in the London press, the "prospectus" of a company proposing to operate mines in Plumas County, Cal., reads like sober truth. This latter concern styles itself "a parent company;" with £125,000 capital, and proposes to do anything and everything in the Klondike region, from supplying "reindeer tanned skin coats with fur sleeves" to "town sites, water lots" and bonanza placer claims on Bowlder Creek. Little matters like sawmills, trading stores and railway franchises are scattered in merely as seasoning. Any one buying five hundred shares and making certain promises will be carried free from England to the Klondike and return, and paid £200 per year for two years. The usual array of big names head the list of "directors."

THE 17th of May will be the four hundredth anniversary of the arrival of Vasco de Gama at Calicut, East India, after accomplishing the first circumnavigation of Africa.

A NEW BALL BEARING.

In the ball bearing shown in the accompanying illustration and patented by Ole Lunde, of Elgin, Illinois, two or more circular series of bearing balls and an intermediate series of separating balls are employed. It will be seen that a very novel arrangement of inner cone-bearing surfaces is provided. These bearing surfaces are formed by two collars on the axle, one adjustable toward the other, and an intermediate ring. This ring has a pin which projects into a recess or groove in

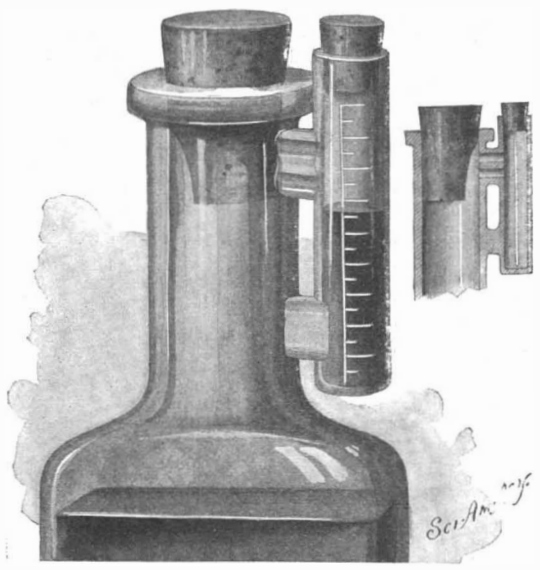


LUNDE'S BALL BEARING.

the axle, whereby the ring is free to slide longitudinally along the axle, but is made to rotate with the axle. By this arrangement it is evident that the ring will adjust itself and take a proper position between the two rows of balls. The exterior bearing surfaces are provided by two bearings adjustably fitted in the hub and spaced to receive a ring which embraces the central series of separating balls, the ring having a groove with inclined sides to receive the balls, and the bearings having surfaces oppositely inclined to the surfaces on the axle collars. The automatic adjustment of the sliding bearing ring on the axle and the series of separating balls are designed to prevent sliding friction and grinding and to distribute the load evenly on the two series of bearing balls.

A COMBINED BOTTLE AND MEASURING DEVICE.

We present herewith two views of a novel bottle which has been patented by Lewis K. Larrison, of Schooley's Mountain, New Jersey. The purpose of the invention is to combine with a bottle, a vial or smaller vessel into which liquid can be poured without removing the stopper and exposing the liquid to the contaminating action of the air. Two lateral members connect the vial with the bottle, the lower member being solid and the upper having two passages. One of these passages supplies liquid to the vial, the other permits the escape of air from the vial to the bottle. The stopper of the vial is of the usual shape. The stopper of the bottle is cut away or formed with a recess at one side as shown, and when its plain side is presented to the passages it will close the latter and cut off communication between the bottle and vial, but when the stopper is given a partial turn to present its recess to the passages, liquid from the bottle may freely pass into the vial. Thus the stopper forms a valve which controls the passages. When a sufficient amount of liquid



LARRISON'S BOTTLE.

has been collected in the vial and the bottle stopper turned to close the passage-ways, the vial stopper may be removed and the liquid poured off. The vial is preferably graduated according to any system of measurement, enabling the exact quantity which enters from the bottle to be accurately determined. A bottle constructed after this method would be very convenient in the administration of medicine, since a dose could be accurately measured in the vial and the medicine directly drunk therefrom without the aid of a spoon.

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THE WINTON MOTOR CARRIAGE.

A ride in a motor carriage is a comparatively new and delightful sensation. With its easy springs, which supplement the pneumatic tires, the vehicle rides along without effort and without anxiety for an overworked horse. The ownership of an automobile carriage is the realization of a dream which has haunted us ever since the introduction of the steam engine, and the experiments which have been tried in the last fifty years furnish an interesting chapter in the history of invention. Within the last few years this dream has been realized, and we can now glide lazily along, propelled by one of the products of petroleum or by electricity. The idea of having gained such mastery over nature that we can, by the touch of a lever, be propelled with ease, comfort and safety at a speed outrivaling the horse or bicycle, is at once so captivating as to be irresistible. Though the final emancipation of the horse may be long deferred, still the motor carriage of today is perfectly practical for the pleasure vehicles of those who can afford them. Strange to say, Europe in this industry has set us an example. For several years the motor wagon has been in common use in France and Germany, and now the horseless vehicle has been perfected in America. Among the notable carriages which are built and used in the United States are those made by the Winton Motor Carriage Company, of Cleveland, O. This carriage has been tested very successfully by a series of hard trips, as from Cleveland to New York, and their carriages have been in constant use during the past two winters in all kinds of weather and over every condition of roads. This is far more practical than running carriages over race-courses to demonstrate their speed. But the Winton carriage made a mile in 1:48 on a circular track, on Decoration Day, 1897. This is, we believe, the world's record for a horseless carriage for one mile. This seems to indicate that their carriages are not only serviceable, but are capable of developing great speed. The success of these vehicles fully demonstrates the practicability of the self-contained hydrocarbon motor. With gasoline safe to handle, cheap and everywhere available, we have a primary power suited to the wants of locomotion. The pneumatic tire, which made the bicycle a commercial possibility, finds its usefulness on the motor carriage, adding immeasurably to its comfort and durability. The suspension wire wheel and ball bearings also add greatly to the ease of the motor carriage. The Winton motor carriage shown in our engraving is a light single-seated vehicle of phaeton type and shows that a motor carriage can be built so that it is not a mechanical monstrosity. The design of the carriage is very pleasing. It is finished in Brewster green, with leather cushions and nickel trimmings.

THE WINTON MOTOR CARRIAGE.

The driving mechanism is snugly concealed in the vehicle. The motor is the single hydrocarbon type of special construction. It is simple, powerful and compact, and is practically free from noise and vibration; and by an ingenious and simple arrangement the motor is absolutely under the control of the driver, who can run it at any speed from three to twenty miles an hour, without affecting its driving power. The motor can be speeded from 200 revolutions to 900 or 1,000 per minute in about three seconds and almost as quickly slowed down to a governed speed of 200. The speed of the carriage is at all times under variable control and can be regulated and held at will anywhere from zero to the maximum power of the motor. The carriage is operated by levers conveniently placed, which engage, release or reverse the driving mechanism, applying the brake, placing the vehicle under perfect control. The motor, being placed in a horizontal position, neutralizes the vibration, making a light-running, easy carriage. The carriage will seat three people, although intended for two. It uses common stove gasoline, which may be purchased at any village, so there is little danger of being left in some country town without means of proceeding. Each carriage carries a sufficient quantity for a day's run of seventy-five miles over ordinary level roads. The cost on the average is less than half a cent per mile. There is no danger from fire or explosions. All the working parts are perfectly protected from dust. The company has just built and delivered four new carriages.

A Life Line for Niagara Falls.

Frequent disasters on the Niagara River above the falls, whereby people have lost their lives by being swept over the cataract, have led to the agitation of the advisability of stringing a life line or cable across the river from the New York State mainland to the Canadian shore, at a point above the breakers and below the line of navigation. The object of such a cable or life line would be to catch unfortunates who are caught in the strong current through being unacquainted with the river, or have their boats upset during a storm. In the last disaster of this kind three men lost their lives by drifting on the current so far down stream that they were unable to regain the shore. They were members of a camping party. Letters have been written to Gov. Black on the subject, and it has been suggested that the commissioners of the two great free parks at Niagara take active parts in the construction, as the line would extend between points under their domain.

The danger line above the falls is a short distance above Goat Island, where the waters divide, part going down the Canadian channel and over the Horseshoe Fall and part between Goat Island and the New York State mainland over the American Fall. The suggestions for this life-saving construction have taken various forms, but none has received official approval as yet. One of the substantial ideas advanced for the line is that piers be erected at points between the two shores on which a heavy rope, chain or wire cable might be stretched, and that a well insulated wire be also strung through which a supply of electricity could be sent to be used in lights on the piers at night, to determine the location of the line in the darkness. Thus any person being carried down the river at night would be made aware of its presence before reaching it. There is no doubt that had such a life-saving device been in place in the past, several lives would have been saved. As yet, however, no definite steps have been taken for its construction.

Petroleum Briquettes.

In a process for making petroleum briquettes, described in Kuhlow's, petroleum refuse is worked up in such a manner as to assume the form of a solid substance, easily handled and constituting a cheap and convenient fuel. About ten per cent of soda lye, with about ten per cent of any fatty matter—tallow, for instance—is heated in a boiler, either by superheated steam or with exclusion of air; and so much petroleum refuse is then added to the heated mass as to make up 100 parts. The whole is heated with constant stirring for about an hour, the time varying with the mode and intensity of heating; but the temperature must never be allowed to reach the boiling point of petroleum, because in that case a large quantity of froth would form. In this incipient state of saponification the mass acquires the property of taking up large quantities of very fluid rockoil, and, if this incorporation of the mass should proceed too slowly or remain incomplete, it may be hastened by the addition of a little soda lye. In a short time the saponification of the grease with the fixing of the petroleum will be effected, and the mass thus produced may be run into moulds and allowed to cool; when it may be cut into pieces of any desired form. According to the use for which the briquettes are destined, they can during manufacture receive the addition of coal-dust, sawdust or other refuse, and, if it be desired to obtain a product of less firm consistency, the grease may be entirely or partially replaced by resin or resin acid, the product in either case having a content of more than 80 per cent of petroleum, more than 90 per cent of combustible substances and less than 5 per cent of incombustible residue.

Expansion and Contraction of the Eiffel Tower.

The daily movement of the Eiffel Tower, due to expansion and contraction, has been studied by Col. Bassot, who recently explained to the Academy of Sciences that the expansion of the metallic components of the structure produces a torsion movement from sunrise to sunset which traverses a curve of ten centimeters, says Industries and Iron. This movement is repeated in an inverse direction during the night, as the column becomes cooled, so that the lightning rod on the summit of the tower is in constant motion. Col. Laussedat, director of the Conservatoire des Arts et Métiers, being appealed to for confirmation of Col. Bassot's statements, stated that he had carefully followed Col. Bassot's investigations, which extended over ten years, and that the results given were perfectly exact. The laws of the expansion and contraction of iron by heat and cold are well known, and the tower simply obeys the physical law of temperature influence. In summer the expansion is superior to that in winter, and the movement reverses at night, owing to contraction due to the cooling down of the mass. Yet this twisting, this torsion, in no case compromises the solidity of the structure, which is absolute.

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The New York Zoological Society.

The New York Zoological Society is making great progress, and soon work will be begun on the grounds and buildings. An agreement has been made with the city whereby 261 acres of land in South Bronx Park was set aside as the site of the New York Zoological Park, subject to some conditions, such as that the collections and animal buildings are to cost not less than $250,000. The city is to prepare the ground for occupancy, and maintain the zoological park when established. The estimate of cost of improvements to Bronx Park is $125,000. Immediately after the bill became a law, work was begun on the elaboration of the general plan of the Zoological Park. The preliminary plan had been submitted to two zoological experts, Dr. C. Hart Merriam and Mr. George Bird Grinnell. Their opinions were valuable and suggestive, and are published in the report of the society which has just appeared.

The preliminary plan was approved by the executive committee and a close topographical survey was made of the ground and where the most important buildings are to be located, and a complete geographical survey of the entire park was also made. At every step expert advice was called whenever matters of architecture, engineering or landscape gardening were in question.

Messrs. Heins and LaFarge were appointed architects, and were commissioned to develop especially the architectural and landscape features of the main court and its main approaches. Mr. C. N. Lowrie was regularly employed for the landscape treatment of the portions outlying the main court. The director, Prof. W. T. Hornaday, co operated in and partly supervised this work, so that the scientific and practical requirements should be met at every point. The superintendent of the Zoological Garden at Philadelphia, Pa., Mr. A. E. Brown, Carl Hagenbeck, of Hamburg, and Prof. D. G. Elliot, of the Field Columbian Museum, were consulted, and after several months of labor the final plan was drawn up, and approved by the Board of Parks.

It is intended to raise a park fund of $250,000 for buildings and collections, and of this amount $103,500 has been subscribed during the year. It is hoped that some rich men may feel like erecting buildings, which would make a highly attractive individual memorial, the cost varying from $1,000 to $75,000.

A Rapid Developer.

The distinguishing feature of the metol developer is that it brings out the details on the surface of the dry plate very quickly, but requires a little time to gain density. In the new developer recently introduced, named ortol, and of the same general character as metol, we have a developing agent of remarkable rapidity, yet possessing the good qualities, as regards freedom from producing chemical fogginess, of other developers, and a rapid building of density that is astonishing. The density-producing quality appears to keep pace with the rapidity of detail production on the surface. The consequence is, the possibility of developing a dry plate as quickly as a wet plate of olden times is fully realized. The speed of development may be regulated by the addition of bromide of potassium or by dilution with water. Experiments we have made with the developer show that a fairly good result can be obtained with almost any kind of exposure. If a plate is considerably over-exposed, the developer will cause the image to flash out in two seconds, yet in that short time it will gain enough density to be a soft negative after fixation.

Ordinary exposures can be finished in from twenty to thirty seconds. We developed, with four ounces of developer, a dozen four by five plates, two at a time, in less than half an hour, a larger part of the time being occupied in removing the plates from the holders, washing and immersing in the fixing bath.

The developer is prepared in two solutions, as follows:

A.

Water	32 ounces.
Meta-bisulphite potassium (crystals)	113 grains.
Ortol	225 "

A chemically pure quality of the potassium salt, in crystals, should be used, and may be obtained from the dealers supplying ortol.

B.

Water	32 ounces.
Sodium sulphite (chemically pure crystals)	5½ "
Potassium carbonate (chemically pure)	1¾ "

To the above eight grains bromide of potassium can be added or used separately, as desired. We prefer the latter method, dropping a few drops of a 10 per cent solution in the developer according to circumstances. In other cases it is recommended that a few drops of a very weak hyposulphite of soda solution (1 ounce of hyposulphite in 20 ounces of water) be added.

To prepare the developer for ordinary exposures, mix with 1 ounce of the A solution, 1 ounce of the B solution, and add 1 ounce of water. If this produces too much density in the negative, the solution can be diluted considerably more with water. Greater contrast is produced by increasing the quantity of A and decreasing B. The color of the developed film is a deep chocolate brown—a color desirable for transparencies. The ortol solution keeps well and may be used repeatedly until exhausted. We think it is a very promising developer and certainly one which has the merit of producing easily, clear, crisp, quick-printing negatives.

A Year's Passengers to New York.

The customary statistics relating to the passenger traffic across the Atlantic have been published, says The Shipping World. They will furnish interesting study for the curious. The number of passengers carried to New York continues to diminish. The total for 1897 is given as 282,936, as against 351,573 in 1895, and 595,313 in 1891. On the other hand, the total number of trips made was greater last year than in any previous one. It would at first be inferred that the year was a bad one for the passenger lines, but the effect of the rate-maintaining conference must be remembered in any such consideration. The decreases mentioned above are shown in respect of both cabin and steerage passengers. The Cunard Line heads the list for cabin passengers carried with 15,196, but it is singular that the two services of the North German Lloyd, together, the Bremen (12,589) and the Mediterranean (2,607), carried precisely the same number—15,196. The figures for both classes appear as follows:

Line.	Cabin.	Steerage.
Cunard	15,196	17,303
*N. G. Lloyd	15,196	40,415
American	14,443	11,322
*Hamburg-American	10,866	17,323
White Star	10,104	19,271
Cie. Trans	6,044	14,264
Anchor	6,478	*19,372
*Holland-American	2,871	10,503
Red Star	4,493	10,557
At. Transport	1,820	7,280
Allan-State	1,823	1,050
Thingvalla	850	3,201
Fabre	22	11,374
Union	..	2,332
Baltic	..	2,227
Pacific	..	1,010

* Two services.

In every case save in that of cabin passengers carried by the North German Lloyd, a decrease is shown in both classes. The North German Lloyd heads the list of sailings with 121; the Hamburg-American follows with 100; then the Cunard, 61; the White Star and American, 53 each. The highest average number of passengers per ship belongs to the White Star, viz., 553, the Cunard being 534.

Animals' Stores.

A writer on "Animals in Famine" observes, in the London Spectator, that if we examine the stores made by most of the vegetable-eating animals that lay by a "famine fund," we shall find "a rather curious similarity in the food commonly used by them. They nearly all live on vegetable substances in a concentrated form—natural food lozenges, which are very easily stored away. There is a great difference, for example, between the bulk of nutriment eaten in the form of grass by a rabbit and the same amount of substance in the 'special preparation' in the kernel of a nut, or the stone of a peach, or the bulb of a crocus, off which a squirrel makes a meal. Nearly all the storing animals eat 'concentrated food,' whether it be beans or grain, hoarded by the hamster, or nuts and hard fruits by the squirrel, nuthatch and possibly some of the jays. But there is one vegetable-eating animal whose food is neither concentrated nor easy to move. On the contrary, it is obtained with great labor in the first instance, and stored with no less toil after it is procured. The beaver lives during the winter on the bark of trees. As it is not safe, and is often impossible, for the animal to leave the water when the ice has formed, it stores these branches under water, cutting them into lengths, dragging them below the surface, and fixing them down to the bottom with stones and mud. This is more difficult work than gathering hay."

The Current Supplement.

The current SUPPLEMENT, No. 1167, contains many articles of timely interest dealing with the topics of the day. "The Maxim Gun for Naval Use" describes one of the most deadly weapons of modern warfare. "The Deterrent Influence of Modern Arms," by Gen. O. O. Howard, U. S. A. (retired), deals with the subject of warfare and is treated from the professional point of view. "Test of Fighting at Sea by Machinery" is an interesting article by Mr. A. K. Fiske, dealing with modern naval battles. "Malay Life in the Philippines," by W. G. Palgrave, is an article of extraordinary interest and value at the present time. Among the articles dealing with more peaceful subjects are: "The Engineering Research Laboratory in its Relation to the Public," by Prof. W. F. M. Goss. "A Method of Measuring the Pressure at Any Point on a Structure Due to Wind Blowing Against that Structure," by F. E. Nipher. "Learning to Drive a Motor Carriage," by Hiram Percy Maxim. "The English Regalia," "The Working of Long Submarine Cables" and "The Psychology of Invention."

Miscellaneous Notes and Receipts.

Blue Color for Copper.—A steel-blue color on copper is produced by a solution of 20 grammes of potassium sulphide and 20 grammes of kitchen salt in 10 liters of water. Old copper plates of engravings or etchings can be colored with this in an extremely fine tone, since by diluting the solution all the shadings of the design on the plate can be obtained.—Technische Mittheilungen f. M.

Treatment of Oak Parquet Floors.—In order to preserve the original color of oak wood it should not be primed with linseed oil, but the varnish should be applied directly on the new floor. It should not be too fat, i. e., not contain much oil. A fatter varnish is used for the last coat. Linseed oil enters the wood too deeply and darkens it, and as it becomes darker with age the floor will get darker too. Varnish remains more on the surface and can therefore not affect the color so much.—Maler Zeitung.

Protecting the Silkworm.—The world's silk production now amounts to over 28,000,000 kilos, according to a lecture by Dr. Erlenbach before the Society of German Chemists. Europe participates with one-fifth, China furnishes 12,500,000, Japan 6,000,000, Italy 4,000,000, France 900,000, Austria-Hungary 250,000, European Turkey 200,000, Spain 80,000, Greece 35,000, European Russia 1,000, Germany 500 and England 200 kilos. Acting on Pasteur's advice, steps are now taken against the sicknesses of the silkworm by having each butterfly deposit its eggs in a separate pasteboard box. It is then affixed to this box and microscopically examined. If fungi are found on it, it is destroyed with its brood.

Cleaning Varnished and Antique Furniture.—To restore to their original appearance antique pieces of furniture which have become unsightly on account of too frequent varnishing or besmearing by unskilled hands, the following method is employed: Take equal parts of strong alcohol and good oil of turpentine and heat this mixture in a bottle by placing it in hot water. With this warm liquid paint the article, whereupon the old varnish will dissolve at once. The varnish is removed by scraping and wiping, and the spreading, scraping and cleaning is repeated as often as necessary until the surface has become entirely clean again, so that the object may be rendered glossy or dull as desired. This process is especially recommended, since it does not change or attack the color of the wood, as is often the case if lye is used.

The Combination and Cause of the Chimney Deposits in Glass Factories.—Dr. A. Grosse publishes, in the Chemische Industrie, the results of the examinations of three glass factory products, which had formed by depositing in the chimneys of three glass factories. The researches have caused the author to come to the conclusion that the deposits in the chimney canals of glass factories are caused by chlorides. According to his opinion, the deposits have to pass the following five stages in their development: 1. Formation of the chlorides in the pot. 2. Sublimation of the chlorides from the pot into the canal. 3. Action of the sulphurous acid on the chlorides; formation of the sulphates. 4. Increase of the temperature; partial decomposition of the sulphates. 5. Action of the arsenious acid; formation of the arsenites. In conclusion, the author admonishes the manufacturers to use pure materials for the manufacture of glass. Especially great importance must be attached to the freedom of the products from chlorine.

To Produce Photographic Pictures upon Cotton Fabrics by Printing.—E. Kopp publishes an interesting paper on indigo salt in the Bull. d. l. Soc. Ind. de Mulhouse. For a number of years a prize has been offered in the said bulletin for a process to produce photographic pictures upon cotton fabrics by printing—a problem which has not yet been solved. Kopp has made a contribution toward the solution of the question founded on the following facts: Indigo salt was formerly sold in commerce as bisulphite compound. The same decomposed strongly, however, in diffused daylight; even if stored in dark rooms, decomposition set in after a few months. Therefore, Kalle now offers the free "keton" of the indigo salt to the print works, and the consumer has to add the bisulphite himself directly before use. Kopp had made the observation that cotton goods prepared with indigo salt, if they had been exposed to the light for some time before treatment with soda lye, did not show a nice blue effect. On this he based his photographic process. He prepared the cotton fabric with:

Indigo salt	7·5 grammes.
Sodium bisulphite, 40° Bé	0·01 liter.
Soda	1·0 gramme.
Water	4·0 c. cm.
Wax	$\frac{1}{10}$ liter.
Gum water	0·3 liter.

Dry with exclusion of light and the fabric is prepared for the photographic printing. Expose the texture, according to the description of the cliché and the concentration of the color, one hour to one day to the sun. The design forms in yellow, passing more or less into dark brown. Develop with caustic soda lye of 15° Bé at 62° Cent. on the foulard, wash and dry.

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A CHARACTERISTIC GROUP AT THE BROOKLYN NAVY YARD.

(Continued from first page.)

way of weather is obvious. In addition to the ships mentioned, our view of the navy yard includes the "Cincinnati," seen astern of the "New York," and the composite gunboat "Newport," both of them fine seaworthy boats, sitting well up out of the water and capable of fighting anywhere and at any time that the country calls for them.

Another improvement that characterizes all of these ships is the possession of a numerous rapid-fire battery. Such is the speed of fire and the all-round superiority of the rapid-fire over the old slow-fire type of gun that no ship can be considered thoroughly up-to-date which does not include these weapons as a part of its armament. Other things being equal, the effectiveness of a gun is directly proportional to the rapidity with which it can be loaded, sighted and fired; and as the rapid-fire gun can deliver from four to six times as many shells in a given time as one of the slow-fire type, it is evidently, as far as its offensive powers are concerned, just that much more efficient.

The "San Francisco," a 4,098-ton ship, carries a main battery of twelve 6-inch slow-fire guns, and the "Cincinnati," of 3,213 tons, is armed with one 6-inch slow-fire and ten 5-inch rapid-fire guns. During one minute's firing the former could deliver from twelve to eighteen shells, capable of penetrating fourteen inches of iron at the muzzle, whereas the smaller boat in the same time could discharge from her rapid-fire guns alone from fifty to seventy shells, each capable of penetrating about the same thickness of iron as the 6-inch shells of the "San Francisco." Provide the two ships with gunners of equal skill and pit them against each other in a naval duel, and the victory will rest with the smaller ship.

The speed of the rapid-fire gun is due to the fact that the shell and the charge are put up in a metallic cartridge, thus doing away with the need for sponging after each discharge, and also enabling the loading to be done in one operation. The breech mechanism is so arranged that the act of opening the breech starts the empty cartridge shell, enabling it to be easily withdrawn by hand. A further and important gain in speed is realized by attaching the sights to the stationary gun carriage instead of to the gun, and permitting the gun to recoil independently of the sights. By this arrangement the gun, when it returns automatically to the firing position, lies on the same point on which the gunner last sighted it, the training and elevation being unchanged by the discharge. If the object of attack is stationary, no change in the sighting is necessary when once the range has been found, and if the object is moving, as in the case of a ship, all the gunner has to do is to make the slight change in the sighting required by the change in position that takes place in the ten seconds interval between each discharge.

Of the ships shown in the illustration, the "Iowa" carries as part of her main battery six, the "Newport" six, and the "New York" twelve 4-inch rapid-fire guns. The "Brooklyn" supplements her powerful 8-inch rifles with a broadside battery of twelve 5-inch guns, and the little "Cincinnati," though but one-third the size of the armored cruiser, carries ten of the same rapid-fire weapons in broadside.

Crystallization of Salts.

J. Leadbeater gives instructions for the crystallization of salts on glass slides which should be useful to anyone who requires preparations for the lantern or micro-polariscope. Such salts as barium nitrate, potassium chlorate and oxalate, microcosmic salt, sodium oxalate and nitrate, zinc or copper acetate, iron sulphate and uranium nitrate should be dissolved in hot water to make saturated solutions, and the addition of a little sugar tends to fix the crystals more firmly to the slides. For lantern slides, beer may be used as a solvent instead of water and the sugar can then be omitted. Phthalic acid, benzoic acid and other compounds insoluble in water must be dissolved in alcohol. The glass plates must be perfectly clean, and the solutions may either be applied with a camel hair brush or poured on in the same way as collodion when used to coat photographic plates. After draining slightly, lay the slides perfectly flat for crystallization to take place, taking care, of course, to protect them from dust. Photo engravings representing slides of potassium ferrocyanide and ferricyanide, ammonium chloride, magnesium sulphate, and borax illustrate the paper, and show that the process, by which presumably the slides have been prepared, recommended yields satisfactory results.—Spatula, iv., ii.

SHETLAND hose is known to excel in the unusual fineness of the wool used for it, which is furnished by the lean Shetland sheep. As is reported by Chambers's Journal, the wool of this animal, which is thriving in a comparatively raw climate under scanty conditions, is not obtained by means of shearing, but by plucking, which is said to be harmless as far as the animal is concerned.

Electrical News and Notes.

In consequence of a telephone wire falling upon the overhead wires of the electric street tramways at Zurich, Switzerland, the central station of the telephonic service, which has 5,000 subscribers, caught fire and was completely destroyed.

The Telephone Replacing the Telegraph.—The Pan Handle Railway is putting in telephones at points where improvements are in progress, and in this way furnishing a means for facilitating the movement of trains without the expense of telegraph operators, which has been the custom heretofore. This is only one of many cases in which the telephone is crowding out the telegraph, and we may expect many more such.

Chicago Electric.—Chicago has at present some 1,248 fire alarm boxes, 1,294 police telephone boxes, 2,700 miles of overhead and 860 miles of underground wire, a municipal lighting system, including 1,460 arc lamps of 2,000 candle power and three large electric light plants. The city also contains private plants to the number of 400, and a vast quantity of wire, poles, street cars and other apparatus employed in the production and use of electricity.

Electrical Production of Phosphorus and Calcium Carbide.—Dr. Borchers, in a recent number of the Zeitschrift für Elektrochemie, reviews a new process for winning phosphorus and calcium carbide from Thomas slag. In this process tricalcium phosphate is mixed with an excess of powdered carbon, and heated in an electric furnace, whereby calcium carbide, phosphorus and carbonic oxide are formed. The phosphorus passes over into the condenser and is recovered, the yield being claimed to be 80 per cent of the theoretical. Dr. Borchers describes a series of experiments made by himself with a view of converting the phosphates of these slags into phosphides, the latter to serve as a deoxidizing material for overblown iron. The results, however, proved negative, the lime in the slag giving off its phosphorus and going into calcium carbide.

Wireless Telegraphy.—The Marconi wireless telegraphy boom seems to have petered out, says a cablegram of The New York Sun, and the syndicate which kept it going for over a year has arrived at the conclusion that there is no money in it. The fact is, the commercial aspect of this interesting subject led to a fuss long before the improved handling of the old discovery had got beyond the laboratory stage. Big brains are now working upon it, and, in due course, a practical method of utilizing the discovery will probably be forthcoming. Prof. Oliver Lodge, for instance, says he has an entirely new method of telegraphing without wires which will, he hopes, enable him to send messages long distances. He does not depend upon waves, but upon magnetism, which is independent of obstacles; and he believes it will be applicable to signaling between ships and between the shore and ships. Prof. Lodge's ideas are not for sale to any syndicate.

Municipal ownership of electric light and power is in operation in the following cities of Germany, which own and manage the works, says Engineering News: Bremen, Barmen, Cassel, Darmstadt, Dusseldorf, Elberfeld, Hanover, Cologne, Konigsberg, Lubeck and Pforsheim. Except Hanover, all these cities also own the gas works. Aix la Chapelle, Chemnitz, Frankfort, Strasburg and Stuttgart have all built their own electric works, but lease them for operating to private corporations; and, with the exception of Chemnitz, the gas works are also managed by private companies. In the following cities private corporations have built electric works, with the understanding that the cities can purchase them under certain conditions: Altona, Dessau, Gera, Hagen, Heilbronn, Leipsic, Mulhausen, Stettin and Zwickau. The gas works are owned by private companies in Dessau, Hagen, Mulhausen and Zwickau.

A Use for Electric Light Carbon Ends.—At last a use has been found for the unburnt ends of carbon taken from electric arc lamps. Mr. Johnston, the foreman of the smiths' and woodworking shops of the Baldwin Locomotive Works, in Philadelphia, has recently instructed the man who changes these carbons in the lamps throughout the works to save the partly consumed pieces and bring them to him daily. He gets in this way some sixty or seventy carbon stumps, which he utilizes for making a small charcoal fire of great heat and purity, suitable for any kind of special small work not interfered with by the copper coating on the outside of the carbons. Mr. Johnston having shown the way, others engaged in kindred lines of work ought to follow his example. It stands to reason that carbon prepared with so much pains to keep it pure and homogeneous must be serviceable for some of the many uses for which charcoal is required. The copper coating might be an objection for some things, but if the collections of stumps were large enough, it might pay to remove the copper with nitric or sulphuric acid, thus getting an absolutely pure nitrate or sulphate of copper, for either of which there is always a practically unlimited demand in the arts.—Cassier's Magazine.

Science Notes.

Science is continually discovering new wonders. An artesian well driven at San Marcos, Texas, recently found not only water, but a kind of animal inhabiting the water, which is found nowhere else. Specimens have just been received for study at Cornell University. The creature proves to be a blind salamander, nearly white in color, with long slender legs and toes useless for locomotion, but valuable for feeling in the blind darkness of the underground waters. They have been given the graceful name of Typhlomolge.

Prof. S. H. Vines, some years ago, showed an important analogy between the pitchers of Nepenthes sp. and the gastric mucous membrane of animals, by preparing from the secreting areas of the pitcher wall a glycerin extract which had a distinct digestive action on fibrin. This appeared to indicate the formation of a zymogen in the cells and its subsequent decomposition by the action of acids. Later observers having denied the presence of an active ferment, while declaring that the disappearance of proteid matter placed in the pitchers is merely a putrefaction set up by bacteria, Prof. Vines brings forward additional evidence which confirms his original conclusion, that an active digestive process is set up in the pitcher by a proteolytic ferment formed in the gland cells of the walls. In one experiment digestion was set up by a glycerin extract of the pitcher in a solution containing one per cent of prussic acid, and it is asked what organism can digest fibrin in such a solution or retain its digestive activity when kept for several weeks in pure glycerin, as must have happened in some of the experiments had any such organisms been actually present.—Annals of Botany.

Prof. Richards, of Harvard University, has for some time been at work on a revision of the atomic weights of nickel and cobalt. These weights form an apparent exception to Mendeleeff's law, as one would expect the atomic weight of nickel to be the greater instead of being the less, as it really is. It has been supposed that the discrepancy was due to impurities in the metals used by previous experimenters, and Prof. Krüss imagined that he had isolated a new metal—gnomium; but its existence has never been confirmed. Prof. Richards has used great care in purifying his material, and has used in both cases a bromide of the metal for analysis. He finds the atomic weight of nickel to be 58·69, and that of cobalt 58·99, thus confirming previous observations as to the anomalous order of these elements in the periodic system. No explanation can yet be given. Prof. Richards is testing his results by the use of other compounds than the bromide.

A service has been done to women generally by Dr. G. A. Wood, of Chicago, in tests made by him with systematic care to determine the danger, if any, in the wearing of veils. For this purpose he selected a dozen typical specimens of the article and applied the ordinary tests of ability to read while wearing them; and these tests show that every description of veil affects more or less the ability to see distinctly, both in the distance and near at hand, the most objectionable being the dotted sort. Other things being equal, vision is interfered with in direct proportion to the number of meshes per square inch, and the texture of the material also plays an important part in the matter. Thus, when the sides of the mesh are single, compact threads, the eye is much less embarrassed than when double threads are used, the least objectionable veil, on the whole, being that which is without dots, sprays or other figures, but with large and regular meshes made with single and compact threads. Dr. Wood pertinently remarks that, while eye troubles do not necessarily result from wearing veils—for the healthy eye is as able as any other part of the body to resist legitimate strain—weak eyes are injured by them.

J. O. Schlotterbeck and A. Van Zwaluwenburg have undertaken the comparison of the structure of the leaves of Datura stramonium, Atropa belladonna and Hyoscyamus niger, in the hope of determining their characteristic features, so as to help in their identification in the form of fine powder. Unbroken dried leaves when very brittle were soaked in 50 per cent alcohol and then spread out, while before cutting sections they were transferred to 96 per cent alcohol. The sections were mounted in chloral hydrate solution, which acts as a clearing fluid. Stramonium leaves appeared smooth, sinuate, unequal at the base, with round perforations, and a prominent midrib underneath; the belladonna leaves were broadly ovate, narrowed into a petiole, and the entire margin is smooth; hyoscyamus leaves were hirsute, deeply sinuous, and clasping at the base. The dry powders from the leaves were mounted in chloral hydrate solution direct. The stramonium powder contained elongated palisade-cells, stellate crystals, a few cubes, and thick-walled, warty hairs: belladonna powder contained large round crystal cells, full of crystal sand or acicular crystals; while hyoscyamus powder contained prismatic crystals and occasionally some stellate ones.—Pharm. Archives.

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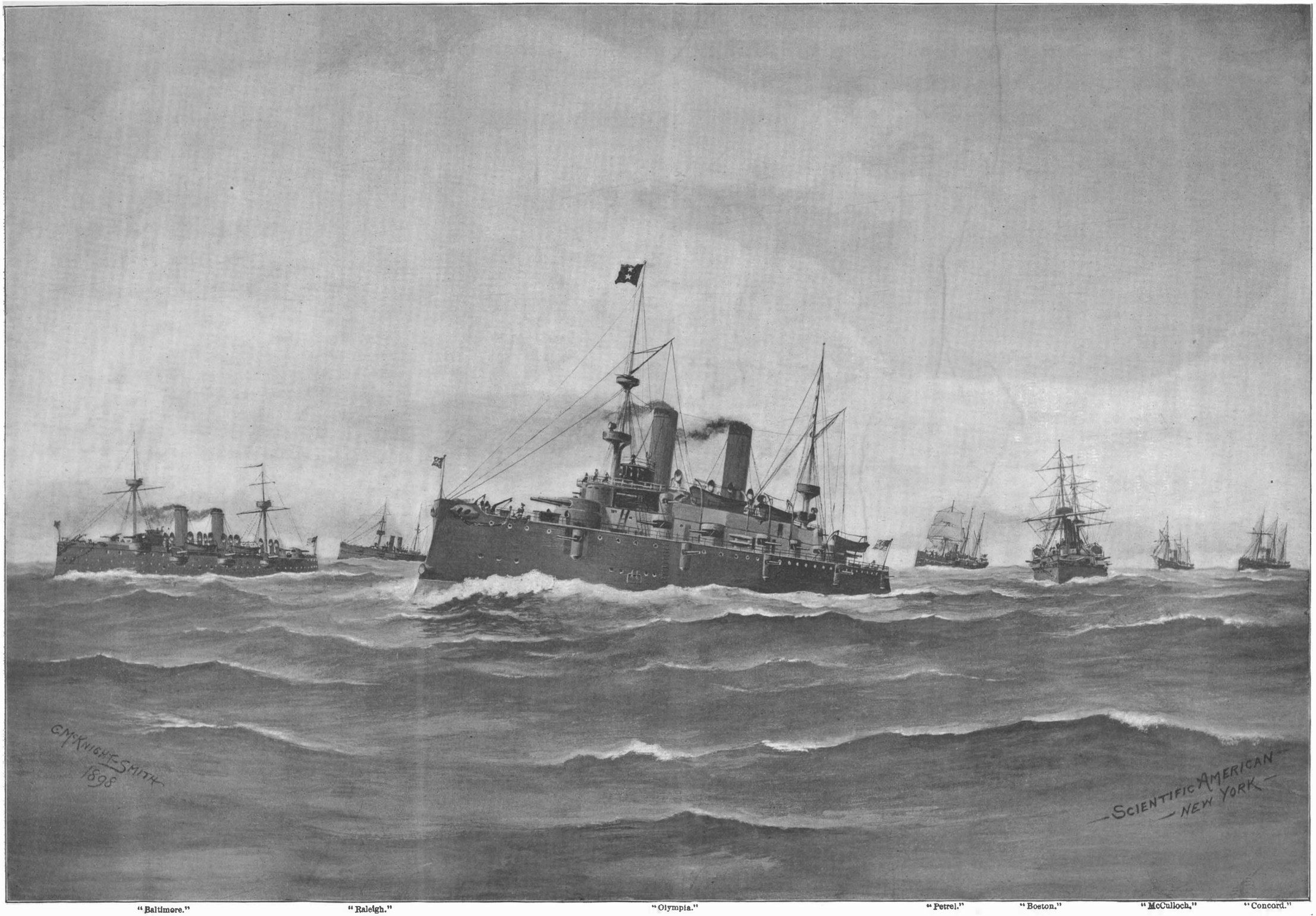

"Baltimore." "Raleigh." "Olympia." "Petrel." "Boston." "McCulloch." "Concord."

THE ASIATIC SQUADRON ON THE WAY FROM HONG KONG TO MANILA.

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THE GREAT NAVAL VICTORY AT MANILA.

Another brilliant victory has been added to the list which has already rendered illustrious the annals of the United States navy, and one more name is placed upon its roll of honor. On the page of history Dewey and Manila will become as inseparable as Farragut and Mobile or Nelson and Trafalgar. Concise as are the tidings which have reached the outside world, and coming largely through a hostile channel, they have served to establish the fact that our new navy has emerged from its first baptism of fire and blood in just the very way that we knew it would—with colors flying and fresh laurels added to its record. The skill and daring with which the attack was planned and carried out have received world-wide recognition, and the estimate of Vice-Admiral Colomb, the leading expert on naval strategy in the British navy, is representative of professional opinion on the other side of the water:

"The boldness of the American commander is beyond question. Henceforth he must be placed in the Valhalla of great naval commanders. Nothing can detract from the dash and vigor of the American exploit or dim the glory which Dewey has shed upon the American navy."

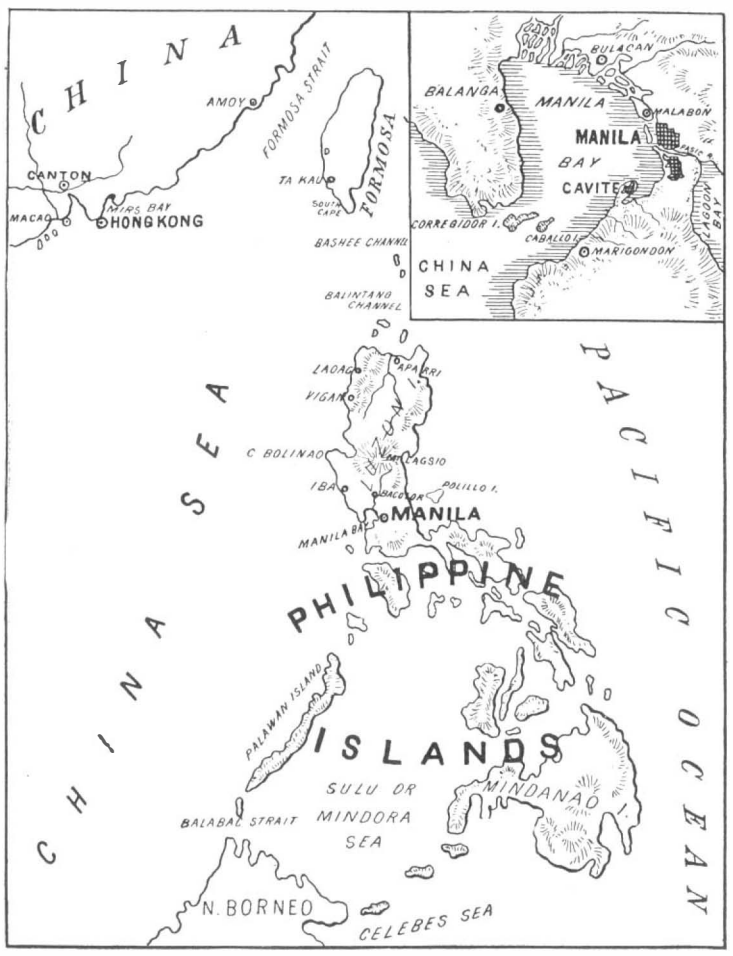
The fleet which sailed from Hong Kong when the declaration of England's neutrality necessitated its departure consisted of nine vessels, two of which were unarmored and acting respectively as a transport and a collier. Of the other seven, one, the "McCulloch," is one of the revenue cutters which have been armed and added to the navy as part of its auxiliary fleet, two are gunboats and the other four are protected cruisers. Our illustration shows this fleet proceeding under easy steam to carry out its instructions, which were to sail for the Philippine Islands, destroy the Spanish fleet and take the capital city, Manila. The distance from Hong Kong to Manila is about 600 miles, or about 60 hours' steaming at economical speed, and on the afternoon of Saturday, April 30, the American squadron was off the coast to the north of Manila.

A study of the fortifications of Manila Bay and the tables given below of the two opposing fleets enables us to judge of the difficult and hazardous nature of the feat performed by Commodore Dewey. The composition of the American fleet is accurately known, and the table of the Spanish ships is probably complete, the only doubt being as to the number of small gunboats that were engaged in the action.

From the comparison it is evident that the Spanish fleet under Admiral Montijo was superior in numbers, while our fleet excelled in the size, speed and fighting qualities of its individual ships. The flagship of the American squadron was the "Olympia," one of the finest vessels in the navy. She was built by the Union Iron Works, San Francisco, and on her trial exceeded the contract speed by 1·7 knots, maintaining an average of 21·7 knots for four hours. Her main battery consists of four 8-inch rifles disposed in two Harvey steel turrets and ten 5-inch rapid-fire guns. Protection is assured by a steel deck 4¾ inches on the slopes assisted by a belt of cocoa-fiber and another belt of coal. The "Baltimore" and "Boston" carried between them six of the formidable 8-inch rifles (this by the way is one of the most popular weapons in the navy) and twelve 6-inch slow-firers. Another 6-inch slow-firer was carried on the forecastle of the "Raleigh," and ten others were divided between the two gunboats. The "Raleigh" also carried a powerful battery of ten 5-inch rapid-fire guns, and on the "McCulloch" were four 4-inch guns. The total armament of the fleet consisted of ten 8-inch rifles capable of piercing 20 inches of iron at the muzzle; twenty-three 6-inch rifles good for a muzzle penetration of 14 inches; twenty 5-inch rapid-fire guns capable, in the skilled hands of our gunners, of discharging 140 carefully aimed shells each minute, each of which can penetrate 13 inches of iron.

The flagship of the Spanish fleet was the "Reina Christina," a steel vessel of 17½ knots speed armed with six 6·2-inch rifles. These guns are of the Hontoria pattern and are credited with a muzzle penetration of 14·3 inches of iron. In the hands of competent marksmen they should have been capable of penetrating the thickest armor carried by our ships; but unless the shooting was better than that exhibited against Admiral Sampson's vessels at Matanzas, it is not likely that our boats suffered serious injury from them. The next most effective gun was the 5·9-inch Krupp rifle, of which seven were carried by the "Castilla" and "Velasco." It can put a shell through 11½ inches of iron. In addition to these the fleet mustered sixteen 4·7-inch Hontoria guns, good for a penetration of 10½ inches of iron at the muzzle. The total armament of the fleet in the larger rifles was six 6·2-inch guns, seven 5·9-inch and sixteen of 4·7-inch caliber, all of them slow-firers.

We have taken no account in either table of the secondary batteries of 6-pounders, 1-pounders and machine guns, as it is not probable that these played any important part, owing to the long range at which the fight appears to have been carried on.



PLAN OF THE PHILIPPINE ISLANDS AND MANILA BAY.

Now, if we regard the battle of Manila as a conflict between fleets, it is evident that Commodore Dewey's ships had an overwhelming superiority; but when we bear in mind that the little group of vessels was engaging not merely the Spanish fleet but the Spanish forts, beneath which it had run for shelter, the conflict takes on an altogether different aspect, and the odds look to be strongly against our invading squadron.

Manila Bay, as will be seen from the accompanying map, is a capacious landlocked harbor, in the entrance to which are two islands known as Correjidor and Caballo. The entrance is about twelve miles wide, but the presence of the islands narrows the waterways to such an extent that they are controlled by a battery of Krupp guns, which is mounted on Correjidor. From the harbor entrance to Manila is a distance of twenty-eight miles, and the approach to the city is covered by the powerful Cavité fortifications, which have been erected along the peninsula of that name. Another fortification has recently been erected on the waterfront in the southern part of the city. From information recently furnished to the press by Mr. J. M. Elliott, former United States consul at Manila, it appears that these fortifications are by no means the antiquated structures which has been popularly supposed. In addition to the 8-inch guns on Correjidor Island, a powerful battery of 8 and 12-inch Krupp guns appears to have been mounted on the northern shore at the entrance to the bay. The Cavité fortifications mounted 8-inch Krupps, and behind the modern earthworks at Manila, according to this gentleman, was a formidable battery of 10 and 12-inch Krupp rifles.

At the present we are largely dependent upon Spanish sources for information regarding the brilliant operations of the 1st of May. It appears that Commodore Dewey forced his way past the batteries at the harbor entrance during the night, and when the eventful day dawned the Spanish on the fortifications and the ships were confronted by the spectacle of the American squadron standing down the bay. The Spanish fleet had taken up a position under the protection of the Cavité guns, which opened fire on our fleet. Commodore Dewey at once closed in, and opened up with all his guns for a space of half an hour. He then drew off and rained in shells from his larger guns, presumably the 8-inch, for about a quarter of an hour. The Spanish fire had weakened under the deadly precision and rapidity of the fire from our fleet, and after another cannonade at shorter range what remained of the Spanish fleet was practically wiped out and the forts were silenced.

The Spanish flagship caught fire early in the engagement and Admiral Montijo transferred his flag to the "Isla de Cuba." The "Don Juan de Austria" was blown up, and according to Spanish accounts several of the other vessels were scuttled to prevent their falling into the hands of the enemy. During the engagement Commodore Dewey kept his ships under way in a methodical formation, and after the destruction of the fleet was accomplished he withdrew to the opposite side of the bay to land his wounded. When this was done he returned to Cavité, which again opened fire, upon which our fleet poured in a crushing fire which effectually silenced the forts. The gallant commodore then turned his attention to Manila and demanded its surrender, sending in a twenty-four hour ultimatum which apparently was rejected. As we go to press a dispatch from Commodore Dewey, the first to be received since the battle, gives in a few telling words the official account of this glorious victory. We cannot do better than give it verbatim: "Manila, May 1.—The squadron arrived at Manila at daybreak this morning; immediately engaged the enemy and destroyed the following vessels: "Reina Christina," "Castilla," "Don Antonio de Ulloa," "Isla de Luzon," "Isla de Cuba," "General Lezo," "Marques de Ducro," "El Cano," "Velasco," transport "Isla del Mindizao" and one other vessel and water battery at Cavité. Squadron is uninjured. Only few men were slightly wounded. DEWEY."

We cannot do better than close with a short sketch of the man whose name is just now foremost in the minds and hearts of his countrymen. Commodore George Dewey was born in Vermont just sixty-one years ago. He was appointed to the Naval Academy when he was seventeen years old, and graduated in 1858. On April 19, 1861, one week after the opening of the civil war, he was commissioned as a lieutenant and assigned to the side-wheeler "Mississippi," which formed part of the squadron that forced the passage of the Mississippi River. Young Dewey was on this ship in the terrific fight which ended in her being blown up. This occurred in the attempt to run by the powerful batteries of Port Hudson. The "Mississippi" grounded right under the guns of the main battery and was struck 250 times in the space of half an hour. The crew escaped in boats to the opposite side of the river. In 1863 the future admiral was serving on the gunboats below Donaldsonville, and the following year he was assigned to the gunboat "Agawam," in which he took part in the bombardment of Fort Fisher. Promotion came in 1865, when he was commissioned a lieutenant-commander.

His subsequent service included a term in the Pacific survey, 1872–75, and seven years in the lighthouse service as Inspector and Secretary. In 1882 he commanded the "Juniata" on the Asiatic squadron, and in 1884 he was given the "Dolphin," one of the first of the vessels of the new navy. From 1885 to 1888 he commanded the "Pensacola," flagship of the European squadron, and in the latter year he was made chief of the Bureau of Equipment and Recruiting, with the rank of commodore. In February, 1896, he was placed at the head of the Board of Inspection and Survey, and on January 1, 1898, he was transferred to the command of the squadron which has just added imperishable laurels to the American navy.

SPANISH SQUADRON.

Name.	Material.	Type.	Displacement.	Speed	Main Armament.
"Reina Christina"	Steel	Cruiser	3,520	17·5	Six 6·2-inch
"Velasco".....	Iron	"	1,152	17·5	Three 5·9-inch.
"Don Antonio de Ulloa".....	"	"	1,130	14·0	Four 4·7-inch.
"Don Juan de Austria".....	"	"	1,130	14·0	" "
"Isla de Cuba"...	Steel	Protected cruiser	1,030	16·0	" "
"Isla de Luzon"	"	" "	1,030	16·0	" "
"Castilla".....	Wood	Cruiser	3,342	14·0	Four 5·9-inch.
"Quiros".....	Steel	Gunboat	315	11·5	Two 6-pounders.

In addition to the above there are supposed to have been a large number of gunboats of the type of the "Quiros" and several second-class gunboats of from 103 to 255 tons.

UNITED STATES SQUADRON.

Name.	Material.	Type.	Displacement.	Speed	Main Armament.
"Olympia".....	Steel	Protected cruiser.	5870	21·7	Four 8-inch, ten 5-inch rapid-fire
"Raleigh".....	"	"	3213	19·0	One 6-inch, ten 5-inch rapid-fire
"Baltimore".....	"	"	4413	20 1	Four 8-inch, six 6-inch.
"Boston".....	"	"	3000	15·6	Two 8-inch, six 6-inch.
"Concord".....	"	Gunboat.	1710	16·8	Six 6-inch.
"Petrel".....	"	"	892	11·8	Four 6-inch.
"McCulloch".....	"	Revenue cutter.	1500	14·0	Four 4-inch.

Also a collier and a transport.

THE services of dynamite have had to be requisitioned to separate parts of the cable machinery in the power house of the Capital Traction Company, Washington, D. C., which was destroyed by fire some months ago. Attempts to separate the hubs of some of the large wheels from their shafts proved fruitless, and as a last resort they were blown off. Notwithstanding the fact that precautions were taken to prevent accident, portions of the wheel were blown a considerable distance, but fortunately no one was injured.

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American Ginseng.

BY M. G. KAINS.

For centuries Chinese ginseng (Panax ginseng) has been to China far more than quinine has been to America. Unlike quinine, however, its use has not been limited to certain classes of disorders. It has been used in America only as a demulcent, a mild aromatic and stimulant, for which purposes our materia medica recommends many more effective drugs. Not so in China; the conservatism of the Mongolian and his belief in the occult have maintained an exaggerated estimate of its efficacy. It has been employed by the Chinese as a specific for nearly every ailment that flesh is heir to, from the most trivial to the most serious. It is further thought, such is the superstitious belief, to procure and insure immunity from all sorts of diseases and even to possess the power of prolonging life. It is well named panacea.

The esteem, nay veneration, in which it is held and the high price that it commands in the market have naturally led to a thorough search for a substitute, not only in eastern Asia but in other parts of the world. Japan and Korea have furnished roots that so closely resemble true ginseng in form that their detection in samples of the genuine is attended with great difficulty. These roots are simply adulterants, since they lack the officinal qualities of the true root. America, however, produces a plant (P. quinquefolium) that not only resembles the latter in appearance but also in its properties, and that has been an important article of commerce for more than a century and a half.

In 1714, Father Jartoux, a missionary in China, published "The Description of a Tartarian Plant called Gin-seng" in the Philosophical Transactions of the Royal Society of London. A copy of this letter fell into the hands of Father Lafitau, a missionary among the Iroquois Indians. In 1716, after diligent search and inquiry among his flock, he succeeded in finding a plant near Montreal, Canada, that answered well the description given by Father Jartoux.

Samples of this root were collected by the Indians and exported to China by the French. These shipments were so well received that a considerable trade was built up, much to the profit of the traders. In Quebec the root was purchased at 2 francs a pound; in China it was sold as high as 25 francs. Trade with China was at that time controlled by the Company of the Indies, which, believing that the market demand was slight, at first allowed its officers to handle ginseng as a private speculation. In 1751, however, seeing that the commerce in this root was becoming important, the company prohibited private ventures on the part of its officers and assumed control itself. In only a short time the price was advanced from 12 francs to 33 francs a pound. But, in 1752, owing to an excessive demand in France, a large quantity of the root was dug out of season and improperly dried in ovens. When this reached China it was found to be of such poor quality that it was refused. This practically ruined the Canadian trade.

The New England States and, later, the sister States as far west as the borders of the Mississippi, profited by the misfortune of their northern neighbors and gradually built up a trade with the Chinese that in 1858 amounted to 366,053 pounds, valued at $193,736, or about 52 cents a pound. Since then the industry has continued to advance until, in 1896, the exportation reached 199,436 pounds, valued at $770,673, or an average price of $3.86 a pound. It will at once be noticed that the quantity exported in 1896 is only about half as much as was shipped in 1858, but that the average price has increased more than seven times. This increase is due to the market demand and an inadequate supply; the decrease in quantity to improper methods of digging more than anything else. (The figures for the exports of 1897 have not yet been made publicly available.)

American ginseng is a perennial herb indigenous in almost all of the States east of the Mississippi, in the first tier of States west of that river and in Canada. It is of very slow growth, even under the most favorable conditions, reaching a commercial size not sooner than the fourth year. In the forest, its native haunt, it rarely produces seed before that time, and even when older this is borne in comparatively small quantities, seldom being more than fifty seeds to a plant. In a state of nature its only means of propagation is by means of seeds. These ripen in September. If, therefore, the plant be dug prior to the ripening of the seed, it is deprived of its only means of perpetuating itself. Yet this is the very thing that happens. The "sang" diggers, a class of people that eke out a livelihood by hunting this root, by trapping and shooting, exercise no judgment as to the season of digging. The plant is dug as soon as found, whether in April, August or November. It is little or nothing to them that the quality is poorer and that the shrinkage is greater than when dug in season. It is also of small moment that the two Virginias have passed laws to prevent the digging until after the fall of the seed. Their nomadic life insures them against capture, and if they are accidentally caught they live at the expense of the State and go back to their old tricks as soon as released. The only other causes of the lessened supply of this root are the clearing of forest lands and the browsing and trampling of stock pastured in the woods.

The visible decrease in the supply of the wild root and the constant increase in the market price have led to many experiments in the cultivation of ginseng. But so frequent have been the failures that its culture has been declared impossible. Such is, however, not the case, since, with proper attention to its peculiarities, it may be grown successfully and profitably. It is of prime importance that the conditions of the forest be closely imitated. In fact, the best place to locate the plantation is in the woods, although, if provided with artificial shade, such as is afforded by an open lattice roof, the plots may be located in the garden or the orchard. It is essential that the beds be made in loose soil retentive of moisture and well supplied with humus, that they be kept free from tree roots, well shaded, fenced off to protect them from stock and covered in the winter with a mulch to prevent damage by severe frost. The seed must never be allowed to become dry or it will fail to germinate. The risk run in saving seed is all the greater since the seed must be protected until eighteen months old, as it will not sprout sooner; i. e., seed ripened in the autumn of 1897 will not germinate until the spring of 1899. The seedlings must be transplanted at least once before being set in the final beds. At all times these beds must be kept clear of weeds by hand. Ginseng will not tolerate the use of tools; horse cultivation is out of the question. Such, in brief, are the principal points to be observed in the cultivation of the plant. The care necessary in the preparation of the root for market is no less important.

In the autumn of the sixth or seventh year—sometimes as early as the fifth—from the time of sowing the seed, the roots may be dug. This is done not earlier than the latter part of September, after the seed has been gathered. Roots that have not attained a desirable size should be replanted, only the largest being marketed.

The operations of washing and drying must be very carefully done, since the mutilation of a root lessens its value in market. In the washing the roots are agitated with a broom in a tub of water. The water is frequently changed to insure cleanliness, and the roots, not perfectly clean at the close of the rough washing, are finished by hand brushes. They are then dried on wire netting trays in a current of warm air, the fibrous portion, or "beard," as it is called, being rubbed off when it becomes brittle. This "beard" is sold to the local drug trade for people who like to chew ginseng. In the drying the roots lose about two-thirds of their weight and become very hard and brittle. They are then ready for shipment.

The cultivation of ginseng is a promising industry. The extension of the cultivated beds is not at present rapid enough to supply the deficiency in the wild root, and an immediate glut is not likely. Should there be a temporary decline in price or should a glut occur, as has sometimes been the case, a grower need lose nothing, since he may leave the roots in the ground for one or more seasons, knowing that they are improving in size and quality. Other advantages in this industry are that it may be made incidental to general farming, may be started and continued without excessive outlay of capital, and may be confined to land that otherwise could not be used for cultivated crops. When properly managed, a very small area may be made to yield a very large proportionate return.

One grower, Mr. George Stanton, Summit Station, N. Y., obtained from 4½ square rods, in five years, 320 pounds of green root, which, when dried, would have been about 106 pounds, worth, at the price then ruling for cultivated root, $575. On the other hand, figures such as these must not be used to compute returns from an acre or acres, since the cultivation of ginseng in large areas is likely to prove infeasible from inattention to necessary detail. Ginseng is an exacting crop and will be disappointing if not properly managed.

WHILE the bubonic plague seems to be spreading in India and threatens almost to equal in fatality the epidemic of a year ago, the French physicians in Algeria have discovered a disease in Africa which, if the meager reports which have been received prove true, is none the less fatal. It is a mysterious disease, and no satisfactory diagnosis has yet been made of it. It first shows itself by the patient having an inordinate desire to sleep. Its symptoms resemble those manifested in laudanum poisoning. If the patient be not at once aroused, he soon falls into a stupor, which is succeeded by death. From its symptoms it has been called by the correspondents of French medical journals in Algeria "La Maladie du Sommeil" (the disease of sleep). Europeans are not susceptible to it, Arabs only slightly, but the negro falls a ready victim. Two doctors of the University of Coimbe have a theory that the disease is microbic. With some bacilli in serum obtained from the blood of a young negro who had died from the disease they inoculated half a dozen rabbits. The little animals became drowsy, and soon died, betraying all the symptoms of the disease.

THE ZOOLOGICAL STATION AT NAPLES.

BY E. O. HOVEY, PH.D.

One of the great attractions of the beautiful city of Naples is the aquarium, delightfully situated on the shore of the bay in the midst of the semitropical foliage of the Villa Nazionale, or city park, the favorite resort of all residents of Naples, whether native, foreign, or transient. This city has peculiar advantages for the location of an aquarium, because its bay is remarkably rich in animal life, many semitropical and even tropical forms being found in its waters, and storms driving in many of those which otherwise are found only in the broader expanses of the Mediterranean Sea. In 1870 Prof. Anton Dohrn, then an enthusiastic young zoologist, went to Naples imbued with the idea of establishing an institution on the shores of the bay, partly for the purpose of exhibiting in glass tanks the beautiful and strange forms of animals to be found in the sea, but mainly for the purpose of studying these animals under the best conditions possible, not only as to their anatomy and their physiological relations to other animals, but also as to their habits, food, etc. Being a man of pecuniary means as well as of enthusiasm and great scientific ability, Dr. Dohrn, after delays and hindrances that would have proved insurmountable obstacles to a man of less determination, attained his desired object, and he established a zoological station which for years has been the principal place in the world for the study of marine animal life, and the influence of which upon the science of zoology has been world wide and of incalculable value.

The building is a three-story and attic structure, built of stone and stuccoed, and consists of two parts, separated by a courtyard and connected overhead by means of bridges. The ground floor of the larger building is devoted to the aquarium, the second, third, and attic floors to offices, the library, laboratories and work rooms. The smaller building is used for receiving, preserving and storing the material brought in from day to day, laboratories and study rooms for some of the officials and others.

The aquarium proper contains twenty-six tanks having glass fronts and lighted from above in such a manner that, as a person gazes into them, he can readily imagine himself, though dry and comfortable, standing on the bottom of the sea with the animals at home about him. There are no open tanks, as there are in the aquarium at Castle Garden, New York City, and no light enters the room except that which comes through the water.

One tank is devoted to starfish, sea urchins and the like, three or four to the different kinds of cuttle fish and devil fish, several others to crabs, lobsters, crawfish and shrimps, while others contain many forms of large and small freely swimming fish. One tank has in it some wonderfully beautiful worms which visitors often mistake for flowers; beside it is a tank full of sea fans, sea feathers and sea pens; and farther along are the delicate medusæ or jelly fish. True coral, precious coral and sea anemones may be found in other tanks, and the wonderful protective and adaptive devices of various animals to their surroundings are well shown. The richness of color, the variety of form and the grace of movement are sources of surprise and delight to every visitor, especially to one who is used to the scantier life and the more somber colors which prevail in northern waters.

The stocking of the aquarium and the supply of material for the naturalists at work in the station is cared for in a very complete way.

The station owns two steam launches, which are used for dredging and other heavy or distant work, and two or more small rowboats which are kept constantly busy collecting jelly fish and other surface forms of life which are driven into the harbor from the open sea. Furthermore, all the fishermen in the bay regularly bring to the station all the animals that come up in their nets that are known to be desired.

Every day the naturalists state what they need for the next day's work, and every evening corresponding orders are given to the crews of the boats belonging to the station. One naturalist may want fifty sea urchins of a kind, another twenty-five starfish, another a large or small number of jelly fish or crustaceans or what not, and each finds his wants supplied the next morning, if the weather has been favorable.

This leads to the mention of another branch of the work here which appeals strongly to the public, namely, the preservation of marine animals, particularly invertebrates, for exhibition in museums and for purposes of study. Dr. Lo Bianco has won for himself and the station an international reputation by the wonderful results which he has attained in the preservation of the extremely delicate and contractile forms of marine life. Beginning work for the station as a fisher boy, he soon showed peculiar ability in handling the animals which were obtained. He studied their habits, anatomy and composition carefully and made many experiments to determine the best method of killing and preparing each species so that it would present a lifelike appearance in the exhibition jar, until he succeeded in obtaining the beautiful results which have been distributed to museums and colleges

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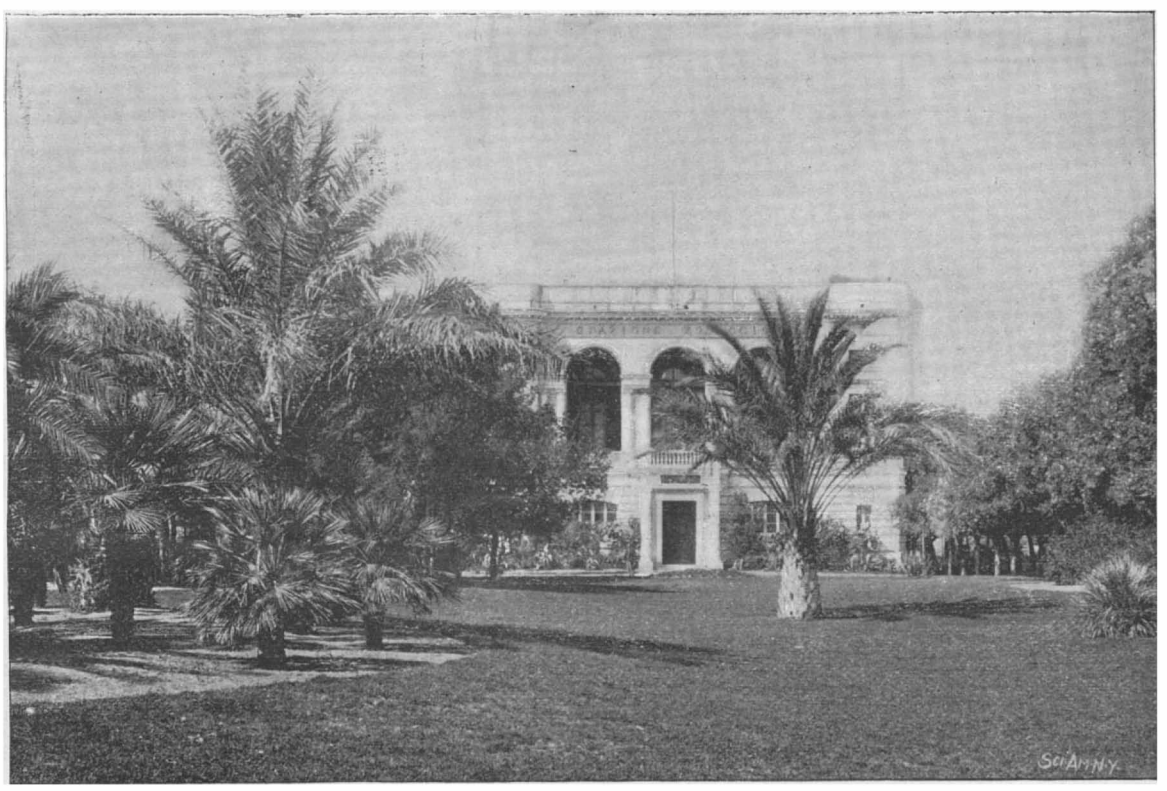
all over the world and have brought to the knowledge of countless thousands some of the wonders of the sea. The animals which are intended for dissection must often be preserved in a different manner from those which are intended for exhibition, and in this line of work, also, the station stands pre-eminent.

Although the aquarium is the most popular portion of the station and the public sees only that and the preserved animals which are sent out to museums, the chief mission of the station, in the eyes of the director, Dr. Dohrn, and of all other scientists as well, is, as has already been stated, to provide a place for the study and investigation of marine life under the best conditions attainable on land, and most of the station building is given up to provisions for this purpose. The regular scientific corps of the institution consists of nine men, including the director, each of whom makes a special study of some form of animal life.

The secretary and treasurer of the institution is H. Linden, to whom the writer is indebted for many items of information regarding the station. The average number of naturalists not connected with the institution who study there is from twenty-five to thirty each year. Each of these is an independent worker along some particular line of study, no elementary instruction being given by the officers. Each student is provided with a table or desk, drawers, racks, bookshelves, microscope, glass ware, alcohol and other reagents, drawing materials, glass tanks with running and stationary water; in fact, with everything needed to carry on his investigations and with animals to work upon. The library is very full upon all subjects bearing upon zoology, a specialty being made of all the periodicals dealing with the science. Furthermore, fully equipped laboratories are provided for the investigation of the chemical and physical questions which arise, and there are optical and photographic rooms and a machine shop for all ordinary grades of work. More than a thousand naturalists have availed themselves of these facilities for investigation.



GROUNDS OF THE NAPLES ZOOLOGICAL STATION.

To start the station in 1872 required about $100,000, besides the land donated by the city of Naples. Friends of science in Germany and England contributed about $40,000 of this amount, but the remainder came from Dr. Dohrn's own fortune. That the Neapolitans appreciate the public character and the value to the city of the station and its aquarium was shown ten years later, when they freely appropriated from their beautiful park the land desired by Dr. Dohrn for a much-needed addition to the original building. The money necessary to meet the running expenses of the institution comes from several sources. Each contributor of £100 sterling annually to the station supports a "table" and has the right to name a person to receive the benefits thereof. At present thirty tables are thus provided for, the Italian government paying for seven, different institutions in Germany for eleven, England for three, Russia and Austria for two each and Belgium, Holland, Hungary, Switzerland and the United States for one each. The institution in this country which always supports a table there is the Smithsonian Institution, at Washington, but some years Columbia University also has one. The tables are paid for year by year, and there is no endowment fund, though Dr. Dohrn is striving now to establish one. The German government appropriates £2,000 a year for the station, the fees of visitors to the aquarium amount to about £1,000, the sale of preserved animals to about £700 and the sale of old material of various kinds to about £100. The expenses, however, always keep pace with the income or get ahead of it.

A NEW island has recently sprang up near the northwest coast of Borneo, opposite the town of Labuan. Its formation is connected with the earthquake which was observed on September 21, last year, near Hudat (British North Borneo). The island consists of argillaceous earth and rock. It is about 200 meters long and 150 meters wide, and has increased in size since its appearance. The emerging of new islands from the ocean, as well as their disappearance, is by no means a rarity. Among others the Graham Island and the Falcon Island are examples of this fact.

THE NAPLES ZOOLOGICAL BUILDING.

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RECENTLY PATENTED INVENTIONS.

Electrical.

ELECTRO-PNEUMATIC PIANO PLAYER.—Fred R. Goolman, Los Angeles, Cal. This automatic piano player is provided with an air duct bridge comprising a block channeled with parallel air ducts and having lateral openings on each side which terminate in enlarged recesses covered by flexible diaphragms. Electrical contact points are so arranged outside the diaphragms on each side as to be closed by them. An equalizing pipe is provided for connecting the chambers on opposite sides of the block. The music may be reversed at any point before the completion of the piece by a specially devised reversing mechanism, which is actuated by a thrust bar attached to a tilting board, the latter being hinged at its lower end and carrying at the upper end a tripping hook adapted to engage with the perforated music sheet. New pumping devices and improvements in the construction of valve boards and vacuum chambers form a feature of this invention.

Engineering.

GAS ENGINE.—John W. Carnes and Charles W. McKibben, Lima, O. This simple, effective and durable engine comprises a cylinder in which a piston operates, a working chamber at one end of the cylinder and a compressing chamber at the other end connected with the supply and with its working chamber by a port, so that when the piston moves in one direction the explosive mixture in the compression chamber is compressed, and when the piston nears the end of its stroke, the two chambers are connected with each other through the port to supply the working chamber with explosive mixture from the compressing chamber. An equalizing valve is placed between the two chambers.

Mechanical.

ROAD MAKING MACHINE.—Charles E. Hacker, Brunswick, Me. In this road-making machine the essential features are a vehicle body having runners connected with each other, cutters carried by these runners and a triangular scraper supported by the body between the rear ends of the runners, the lower ends of the scraper as well as the cutters extending below the body and runner edges. With this machine bushes and weeds may be economically removed, at the same time leveling the ground for bicycle roads and paths.

TABLET MACHINE.—James Cornelius, Ridgewood, N. J. This machine makes a tablet of uniform weight and thickness and, according to its inventor, is capable of changing the size in thirty seconds. The depth of the recess in which the tablet is compressed is regulated by means of a cam. After weighing out the powder of one tablet and adjusting the cam so that the mould will contain just the amount of powder required, the tablets will be made of uniform weight and thickness by merely filling the mould at the top. Each machine is supplied with two sets of moulds and plungers, making the tablets respectively $\frac{5}{16}$ and $\frac{6}{16}$ inch in diameter and of the required thickness. The tablets are delivered automatically below the table free from all powder.

MAGAZINE FIREARM.—Willis H. Ostrander, Boston, Mass. This repeating breech-loading gun is an improvement upon a weapon for which previous patents were granted to the same inventor. In the present arm the improvements made consist of locking or bolt devices and parts designed to operate the extracting mechanism and means whereby the bolting device will also act as a safety device, preventing the triggers being operated when the barrels are opened. Another purpose of the invention is to provide a means whereby the latch plates of the extracting devices will be operated from the hammer and to provide for operating the lock in the safety device by the sears in such manner that the sear of the hammer not in operation will be automatically locked, making it impossible to press both triggers at once. The frame is furthermore provided with offsets which take up the force of the main spring to a predetermined extent, so that the firing pins will not sustain the full force of the spring, as in ordinary guns. Means are also provided whereby, upon the return movement of the barrels, the extractors will be positively placed in a position to act for any one barrel fired or for both barrels if they are fired one directly after the other.

PAPER MAKING MACHINE.—Sebastian N. Miller, Piedmont, West Va. The improvement in paper making machines for which this patent was granted is provided with the usual top couch roll, the beam extending longitudinally above the roll, the casing having in its under side a recess opening toward the roll and open at the end. By this means the guard board strip may be inserted in and removed endwise from the casing. The guard board strip is engaged by pressure screws, and fastenings are secured to the casing at close intervals to the beam, preventing any springing of the casing toward or from the roll and securing the casing in such a manner that its open end is left unobstructed for the endwise insertion and removal of the guard board strip.

Miscellaneous.

CLOCK-CONTROLLED SWITCH.—Franklin L. Mackey, New Castle, Pa. This invention is an improvement in devices for use in connection with electric circuits, and has for its object to make or break the circuit automatically or to switch from one circuit to another, being operated by connection with a clock mechanism, enabling it to make or break the circuit at any predetermined time. The device is intended for use in circuits where it is desired to turn the current upon the circuits and switch it off at certain times.

FARE REGISTER. Edward Fuchs, New York Stencil Works, New York City. In this invention, which is effectively designed to prevent fraudulent manipulation, a series of concentric rings, having racks thereon, register the number of trip fares and a second series register the total fares. A lever and dogs operate the rings, and in connection with these, means are provided that wholly disengage the dogs on the return movement of the lever. Novel resetting devices are also provided.

RAISIN SEEDER.—Cary S. Cox, Fresno, Cal. In this machine the pin cylinder co-acts with a novel composite cylinder made up of yielding and non-yielding portions arranged to provide spaces into which the pins enter and which receive the seed, the machine having the necessary complement of feeding rollers and other co-acting members.

BUTTON AND TIE FOR BRAIDED HAIR.—C. C. Davis, Napanoch, Ulster County, N.Y. An ornamental button is provided which is held between the braids of the hair and carries a string or ribbon which is wound around the braid to form a tie, the free ends of the string being then fastened to the button.

TILING.—C. C. Alexander, Bayonne, N. J. The tiling covered by this patent is made up of round tiles, with cement filling between them. The round tiles may be laid with great facility, and are securely held by the cement which fills the intervening spaces. The invention makes possible an unlimited variety of beautiful designs.

ROLLER SKATE.—Samuel L. Kinsbruner, Berlin, Germany. This inventor has made a departure in roller skates by embodying a crank shaft which is operated by the up and down movement of a hinged plate attached to the foot of the shaft, having a driving connection with the rear wheel of the skate.

ROPE CLAMPING HOOK.—Ansel R. Bradeen, Seattle, Wash. This rope-holding device consists essentially of a link having two parallel side bars connected by a lateral section and a block fitted to slide between the side bars and having a hook projecting therefrom, which hook is bent toward the rear of the link and lies within the margin thereof. The invention is designed for the purpose of firmly holding ropes of all descriptions, particularly clothes lines and hammock ropes.

KNIT FABRIC FOR UNDERWEAR, ETC.—David F. Halstead, Brooklyn, N. Y. A very novel fabric is provided by this inventor. It consists of a cotton body with a lining of fleeced or natural silk yarn. The silk being innermost, the fabric gives the advantages of the expensive all-silk garments, and the goods may be washed in the usual manner without shrinking or hardening. It is claimed the fabric will not cause chafing and has a strength and wearing qualities that make it specially serviceable for cavalrymen, bicycle riders and the like.

MULTIPLE-TUBE WATER HEATER.—Albert P. Broomell, York, Pa. The primary object of this improved multiple-tube water heater is the economizing of fuel. The improvements consist in a peculiar construction and arrangement of valve by which the water may be made to travel quickly and in a comparatively straight course through the heater from the inlet to the outlet, or be made to follow a long winding passage therethrough as may be desired. The couplings of the pipe sections are so constructed and arranged that they may be joined together in a simple manner, enabling the necessary cleaning to be easily executed.

TOOTH FILLINGS.—William F. Davison, Richmond, Va. In filling a tooth after the inventor's simple and effective method, the cavity is first prepared in the usual manner and then nearly filled with cement. While the cement is still plastic, gold is inserted therein and the cement is allowed to harden. The exposed surface of this firmly-seated gold will thus constitute an anchor to which the outer filling of gold is applied in the usual manner. Novel forms of anchors have been provided, answering all requirements that may be necessary in practically applying the invention.

CHECK HOOK.—F. J. Frost, Theodore Souers and Charles W. Cooledge, assignors to George S. Johnson and C. W. Cooledge, Grundy Centre, Iowa. This check hook consists of two sections connected with a teret, the sections being adapted for connection at right angles with each other. Each section has an eye, one eye having an outward leading opening permitting the entrance and removal of the other section. At the opening in one section and at the coacting point of the other section, a mating rib and groove is ranged in an outward direction from the eye, the rib and groove ranging respectively parallel with the eye of the opposite member and at right angles to the eye in conjunction with which it is formed, the grooved and ribbed formations thus offering obstructions to each other until the members are moved twice at right angles.

WAIST BELT ATTACHMENT.—Clement L. Stephenson, New York City. This invention is an improvement in waist belts, having means by which the skirt may be held in position. The invention consists essentially of a sheet metal belt having a wire fastened thereto, the ends of which are bent to form hooks for engagement with the dress.

MARKING CORD.—Georg Karl, Spitzenberg, Tharandt, Germany. The essential parts of this marking apparatus are two stakes, a tension device connected with one stake and a reel movable on and surrounding the other stake. A spring is attached to the reel and engages the stake. The tension device and reel are provided with a cord. The object of this invention is to overcome the many inconveniences which attend the manipulation of the ordinary marking devices.

ELASTIC WHEEL FOR CARRIAGES.—Nicholas Rosenblatt and Sergius Ahscharumoff, St. Petersburg, Russia. In the elastic tire of this wheel, a metallic rim embraces the sides of the tire, the tire being provided with a series of radial perforations each terminating on the peripheral surface of the tire in a shallow cavity and on the inner surface adjacent to the rim in an enlarged recess. A series of metal pins are provided having approximately rectangular heads, the inner surface of which corresponds to the shallow cavities in the surface of the tire, the outer surface of the heads being convex and projecting beyond the periphery of the tire but terminating short of the sides thereof, the shank portions of the pins extending through the tire perforations and the inner end of each shank portion being secured in the enlarged recess. The tire, it is claimed, will not throw mud or moisture sidewise when driving.

HOOK FOR CHATELAINE OR OTHER BAGS.—John Kleinstuber, New York City. This hook is composed of sheet metal having a body portion provided with two recesses stamped therein near one end, with one end wall of each recess removed, forming holes adapted to receive suspending straps, a narrow arm projecting from the opposite end and bent to form a hook, the outer edges of which being rolled over and a fabric secured beneath the rolled edges.

DEVICE FOR DECORATING TILES OR PLANE SURFACES.—G. H. Grundy, Derby, England, and George A. Lingard, Old Normanton, England. A photocollotype printing film for direct printing on tiles and plane hard surfaces, is backed up by an elastic support composed of two layers of vulcanized India rubber cemented together, one of which is a thin upper layer of dense non-elastic rubber upon which the photocollotype film is spread and the other a thicker substratum of elastic rubber. The elastic support is in turn backed up by a smooth-surfaced rigid backing plate. With this device the printing is done in a direct manner by photocollography without the use of transfers.

SEPARATOR FOR METALS.—William J. Dwyer, Hillyard, Wash. This separator consists of a series of tables, a carrier trough common to all of them, a grading hopper at the feed end of the carrier trough, a water pipe extending into the bottom of the hopper and having outlet perforations, another pipe surrounding the first-named pipe and a boxing surrounding the last-named pipe and provided with an outlet. The object of the invention is to save from the pulp or tailings the greater portion, if not all of the metal.

HACK SAW.—George N. Clemson, Middletown, N. Y. In the spaces between the straight teeth of this saw, set teeth are located, the straight teeth being connected directly at like ends partly to set teeth merging tangentially into the straight teeth and projecting to one side of the saw, and partly to set teeth also merging tangentially into the straight teeth but projecting to the other side of the saw, the outer ends of the set teeth so connected all facing in a like direction or toward the same end of the saw. When the saw is used, a clean, straight cut is produced and the teats now left at the bottom of the cut when using the saw as hitherto constructed, are completely removed.

POULTRY HOUSE.—Samuel C. Ashmore, Caledonia, Miss. This inexpensive and convenient poultry house consists of an inclosed frame supported on upright posts and covered by a roof, means being provided for the entrance of fowls to the inclosed structure. Sets of pendent doors are located within the structure, which doors are inclined to each other in pairs and secured together at their lower edges. Roosts are placed between the sets of doors and above the upper set of doors. The house affords a safe and commodious place for hens and chickens, and by special devices the fowls are protected from the depredations of reptiles, animals or thieves.

Designs.

WIRE FENCE.—Jesse H. Srofe, Kokomo, Ind. The essential features of this fence are the horizontal strands and the pickets having overlapping curved tops. The pickets and strands present the appearance of twisted wire and have a fabric-like appearance. The pickets, by their various crossings and turnings, form a series of diamonds and half diamonds.

SUSPENDER BUCKLE PIECE.—William Bloomberg, New York City. The principal features of this design for a suspender buckle piece are a strap-like marginally curved inner member and a similar outer member. These two members are brought together at their end portions and the outer member at its center is bulged outwardly or from the inner member.

TEAPOT OR LIKE ARTICLE.—Austin F. Jackson, Taunton, Mass. The general shape of the body of this vessel is elliptical and its side walls curve inwardly to a smaller diameter at the top with a concave taper. The bottom portion of the body is octagonal and longer horizontally than vertically. The general contour of the cover is conical, the sides being drawn on the lines of a reversed curve and changing gradually from an elliptical base to an octagonal apex, which is surmounted by a knob. The spout is hexagonal in cross section and merges into a pear-shaped nose. The handle is likewise hexagonal and is ornamented by bulbous roots and scrolls.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

PASTEUR. By Percy Frankland and Mrs. Percy Frankland. (The Century Science Series.) New York: The Macmillan Company. Pp. 224. Price $1.25.

This modest volume affords a comprehensive and yet concise and appreciative sketch of the life and work of a great chemist, but one whose valuable researches in a purely chemical line were overshadowed by his studies more especially bearing on infectious diseases and their prevention, the subject of micro-organisms in the economy of nature, the cause and prevention of rabies, etc. Pasteur was born in 1822, the son of a working tanner, in a small French town, and he died in 1895, his funeral being one of great pomp and ceremony at the Cathedral of Notre Dame, Paris. His life was a very active and busy one, but was marked by a long series of well-earned successes, prominent among which were his discoveries in relation to fermentation, anærobic life, spontaneous generation, the vinegar organism, silkworm diseases, the brewing of beer, etc., all of which led up to his study of infectious diseases, researches on anthrax and discovery of anthrax vaccine and the rabies virus. A most worthy memorial of the great chemist and humanitarian has been made in the foundation on a permament basis in Paris of the "Institut Pasteur," for the treatment of rabies and the "scientific study of means practically to compass diseases which decimate the human race—diphtheria, typhoid fever, phthisis, etc." Perhaps, however, it is an even more striking testimonial of Pasteur's place in the scientific investigation and treatment of disease that Pasteur institutes on similar lines have been founded in numerous cities and towns throughout the world.

THE GAS ENGINEER'S POCKET BOOK. By Henry O'Connor. New York: D. Van Nostrand Company. Pp. 438. Price $3.50.

This book not only contains tables, notes and memoranda relating to the manufacture, distribution and use of coal gas and the construction of gas works, but it also has a large amount of data serviceable to engineers in general. Its general mathematical tables, its information about the strength of materials, etc., have been most judiciously arranged, and the book is admirably printed in large, clear type.

A COURSE IN MECHANICAL DRAWING. By John S. Reid. New York: John Wiley & Sons. Pp. 127. Price $2.

The author, an instructor in mechanical drawing and designing at Sibley College, Cornell University, presents in this book the elements of a course of instruction adapted to students in marine, electrical, railway and mechanical engineering. The course has been developed through his own experience as an instructor, and is designed to prepare a young man of ordinary intelligence for the more advanced problems met with in machine construction and design.

THE "HOMER." A Book for the Lover of the Wonderful Homing Pigeon. By F. E. Morganthaler. Cleveland, O.: O. S. Hubbell Printing Company. Pp. 123. Price 60 cents.

This little book is written by one who has for years enthusiastically followed the breeding and training of the homing pigeon, and gives a large amount of practical information relating to the selecting of breeds, care and successful raising of pigeons.

GAS, GASOLINE AND OIL VAPOR ENGINES. A work descriptive of their theory and power, illustrating their design, construction and operation for stationary, marine and vehicle motive power. By Gardner D. Hiscox, M E. Second edition, revised and enlarged. New York: Munn & Company. 1898. Pp. 365. 270 illustrations. Price $2.50.

The second edition of this book, just issued, places the theory and constructive design of the explosive engine within the comprehension of every one interested in this comparatively new and efficient prime moving power. While several chapters are devoted to a simple and plainly described theory of the internal combustion motor, its operation and management, the larger portion is given to the description and illustration of the stationary, marine and vehicle motors, with examples of boats, yachts and horseless vehicles as constructed in the United States. A valuable feature is a complete list of United States patents on explosive motors and their adjuncts from 1875 to 1898, and a list of addresses of builders of motors in the United States as far as could be learned. The work commends itself to every one desiring information as to the theory and practical working of a cheap and safe power.

THE TUTORIAL CHEMISTRY. Part II. Metals. By G. H. Bailey, D.Sc. London, Ph.D. Heidelberg. New York: Hinds & Noble. London: W. B. Clive. Pp. 300. Price $1.

This is one of a series of volumes published at the University Correspondence College Press, London, to provide candidates for examinations and learners generally with text books designed to convey in the simplest form sound instruction, in accordance with the latest results of scholarship and scientific research. Care is taken to avoid complex details where possible, and to give every help that can be afforded a student short of oral instruction and demonstration.

SANITARY ENGINEERING. William Paul Gerhard, author and publisher, 36 Union Square, East, New York City. Pp. 132. Price $1.25.

The author has for some years enjoyed an extended reputation as consulting engineer for sanitary works, and in this monogram treats comprehensively of the leading considerations to be borne in mind to obtain the most effective work. The principal topics discussed are the water supply of cities and of dwellings, sewerage and sewage disposal, prevention of pollution of watercourses, street pavements and street cleaning, garbage disposal, the laying out of cities and towns and their sanitation, sanitary engineering in the case of epidemics and in time of war, etc.

ANNUAL REPORT OF THE MINISTER OF MINES. For the year ending 31st December, 1897. Being an account of mining operations for gold, coal, etc., in the Province of British Columbia. Pp. 451–640.

THE MOTOR ENGINEER'S AND ELECTRICAL WORKER'S HAND BOOK. West Park, O.: William Lintern. Pp. 147. Price $1.

This little book is compiled with a view of furnishing a book of reference in a simple and convenient form for the use of motor engineers and street railway men. The diagrams of the controller connections and combinations will be found of great value in practical work. The diagrams are specially clear, and it is a pity they could not be reproduced on a slightly larger scale.

The American Electrical Directory and Buyer's Manual is a quarterly publication issued by E. L Powers, Monadnock Block, Chicago, Ill. The subscription price is $4 per year. The present number contains valuable statistics regarding central station lighting, including those owned and operated by private corporations as well as those owned and operated by municipalities. It contains buyer's list, in which the manufacturers are carefully classified. It also contains a full list of electrical stations as to capital, name of manufacturer, plant, etc. It will prove of great value to all who are in any way interested in electrical industries.

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The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

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Schwaab Stamp & Seal Co., Milwaukee. Send for cat'g.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7424) W. H. C. asks: Kindly give me a method (such as I can use in a laboratory) for the separation of nicotine from tobacco. I have tried the experiment by digesting the ordinary plug tobacco in sulphuric acid, then mixing it with lime, and distilling, but without success. A. In order to extract the nicotine from tobacco, the leaves are boiled with water, which dissolves the alkaloid, in combination with malic and citric acids. The liquid, having been strained, is evaporated to a sirup and mixed with alcohol, when it separates into two layers, of which the upper contains the salts of nicotine dissolved in alcohol, the lower aqueous layer retaining the greater part of the vegetable matters. The alcoholic layer having been drawn off is next shaken with potash, to combine with acids, and with ether to dissolve the nicotine then set free. On decanting the ethereal solution of nicotine which rises to the surface, and evaporating the ether, the nicotine is left in the form of an oily liquid, which is colorless and perfectly pure, but soon acquires a dark brown color when exposed to air. It is very readily distinguished by its very pungent, irritating odor, recalling that of tobacco, and which is very perceptible at the common temperature, although the boiling point is 480° Fah.

(7425) W. F. A. writes: I have a small fan motor, which is intended to run on 3·2 volt alternating circuit. It is of the brush and commutator type, with 26 poles to the armature core. The commutator has 13 segments. The field has 2 coils. There is also a choking coil in the base. The whole machine is wound with No. 26 wire. The field, armature and coil are all in series. What must I do to it to make it run on 104 volt circuit? A. Without knowing more about the machine, it would be impossible to give more than general directions. You can wind it with a greater number of turns of wire in both field and armature, using finer wire. The best way would be to increase the self-induction of the choking coil. This would cut down the voltage supplied without any loss of energy except that due to the ohmic resistance of the wire in the coil. This extra self-induction must always remain in the circuit. That which is in the machine is probably for regulation.

(7426) D. asks: What is the difference (if any) between statical electricity generated by a frictional machine and the electricity induced in the secondary of an induction coil? A. There is but one electricity, just as there is but one water; but just as water may be more or less in quantity or be under a greater or less pressure or head, so with electricity we may have more or less of it, and it may be under a greater or less pressure. In the so-called static condition of electricity it is under great pressure, that is, it has a high E. M. F. Then its quantity in amperes is usually small. The mode of generating the electricity is of no importance. Electricity is electricity.

(7427) C. R G. writes: A weight clock is running with perfect accuracy. If the weights are changed to very much heavier ones, would the clock run with the same accuracy without adjustment? A. No. The weight or spring of a clock furnishes the power to move the train of wheels. These are so constructed that at each swing of the pendulum or balance wheel a tooth of the escapement wheel strikes upon and gives a slight impulse to the pendulum or balance wheel. This keeps it in motion and up to the proper length of swing. If a heavier weight is substituted, the swing of the pendulum will be made longer and the clock will be likely to run irregularly.

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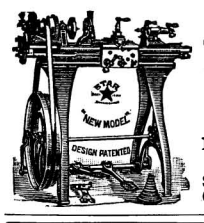

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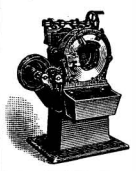

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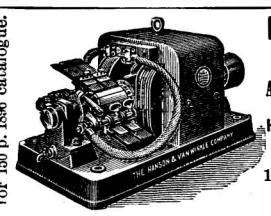

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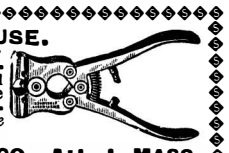

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MAY 3, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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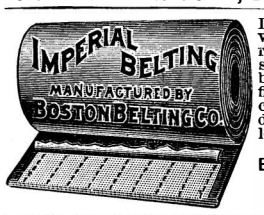

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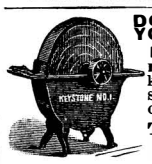

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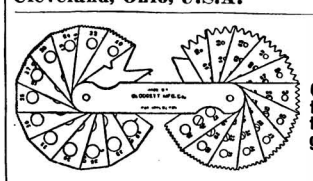

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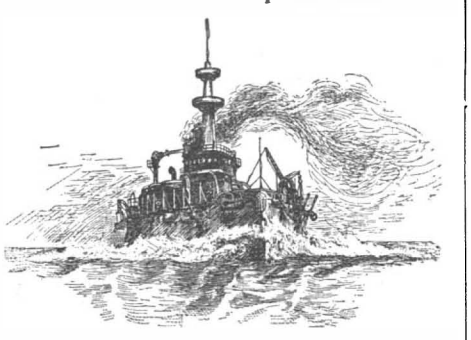

The great desire during the present crisis for accurate information concerning the United States Navy has led to the preparation of a short treatise on the Navy, which has just been published under the above title. Every effort has been made by the publishers to treat the subject in such a manner that it may be readily understood by the reader unversed in naval affairs, and at the same time render the publication a permanent book of reference.

This issue takes the place of the regular number of the Supplement for April 30th, and consists of forty pages.

The number opens with a historical sketch of the birth and growth of the new Navy from 1883 to 1898, in which the programme of shipbuilding authorized in each year is given, together with the classes of ships which it called for.

This is followed by an article which explains the different types of vessels into which a modern navy is divided, and shows, by the assistance of diagrams, the manner in which the various types of vessels are classified. This article will greatly assist the reader in understanding the detailed illustrations and descriptions of each ship which make up the bulk of the issue.

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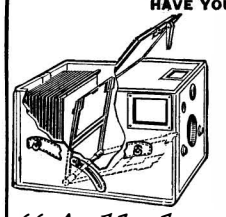

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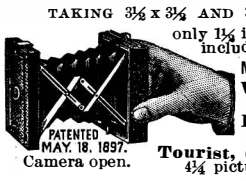

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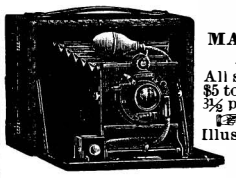

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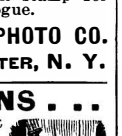

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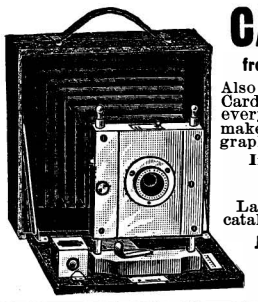

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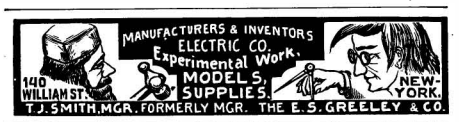

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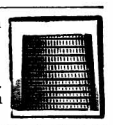

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